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READING LESSONS
IN
HISTORY, GEOGRAPHY, LITERATURE, & SCIENCE.

LONDON
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NEW-STREET SQUARE

THE
ADVANCED LESSON BOOK:

CONSISTING OF READING LESSONS IN

HISTORY, GEOGRAPHY, LITERATURE, & SCIENCE.

TOGETHER WITH A COMPLETE
COURSE OF EXAMPLES IN THE HIGHER PARTS OF
ARITHMETIC, AND MENSURATION.

FOR THE USE OF ADVANCED CLASSES IN SCHOOLS & INSTITUTES.

BY

E. T. STEVENS

ASSOCIATE OF KING'S COLLEGE

AND

CHARLES HOLE

HEAD MASTER OF THE LOUGHBOROUGH COLLEGIATE
AND COMMERCIAL SCHOOL, BRIXTON

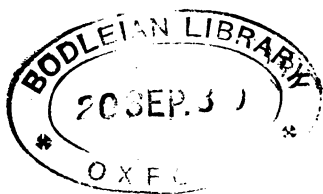
EDITORS OF 'THE GRADE LESSON BOOKS' &c.

LONDON:

LONGMANS, GREEN, AND CO.

1866.

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PREFACE.

IN the preparation of the 'Grade Lesson Books' the Editors sought to teach reading with fluency and expression—to make its exercise a labour of love to the pupil. In the present work, which may be considered a sequel to the sixth volume of that series, they have had a twofold object in view:—viz. (1) To compile a really good reading-book for use in Advanced Classes in Schools and Institutes, and (2) to supply a guide to many of the best works on the subjects treated of. They desire to give useful information, and they hope that, by imparting it in the language of the best writers, they shall assist in the mental culture of youth. By introducing those who may use their book to an acquaintance with some of the best English Classics, they seek to contribute to the formation in them of a pure literary taste; as well as point to them the way by which they may become most effectually furnished in various important branches of knowledge.

The series of Arithmetical Examples in the 'Grade Lesson Books' carries the pupil, by the easiest gradations, up to and including Bills of Parcels, Practice, and Simple Proportion; that in the present work takes him on through Compound Proportion, Vulgar and Decimal Fractions, Decimal Coinage, Interest, Stocks, Evolution, &c. and Mensuration. This course will, it is believed, be found sufficient for the office, the warehouse, and the workshop.

The Editors disclaim any intention to supersede the work of the teacher: their only design is to assist him, and

to furnish his pupils with examples to be worked at home or otherwise. They have given a collection of short rules and definitions in order that the pupil may be enabled to refresh his memory, if necessary, as to the various processes which have been taught in class. In order that the pupil may be enabled to read the lessons with appreciation, the most difficult words and forms of expression in each extract are explained, as far as possible, in the sense in which they are used. These definitions are prefixed to the lesson, and may be advantageously committed to memory by the pupil before he reads it.

The Editors issue the book in the earnest hope that they may become, through it, humble co-workers with those who are engaged in the noble task of opening up the fountains of knowledge to that class of youths and young men who are destined to play so important a part in the future of this country.

They gladly avail themselves of this opportunity of expressing their grateful acknowledgments to the following authors and publishers for their kindness in permitting the use of extracts from the works named below : viz. to—

Charles Dickens, Esq. for extracts from the ‘ Pickwick Papers,’ ‘ Our Mutual Friend,’ and ‘ All the Year Round ;’ Messrs. Sampson Low, Son, & Marston, for extracts from Captain Maury’s ‘ Physical Geography of the Sea and its Meteorology ;’ Messrs. Smith, Elder, & Co. for an extract from Mr. Ruskin’s ‘ Stones of Venice ;’ Messrs. A. & C. Black, for extracts from Sir J. Herschel’s ‘ Physical Geography ;’ John Murray, Esq. for extracts from the ‘ Naturalist on the Amazons,’ by H. W. Bates, Esq., ‘ Industrial Biography,’ by S. Smiles, Esq., ‘ Sinai and Palestine,’ by Dean Stanley, ‘ History of England,’ by Lord Mahon, ‘ Battles of the Peninsula,’ by Sir W. Napier, ‘ Letters from High Latitudes,’ by Lord Dufferin, ‘ Physical Geography,’ by Mrs. Somerville ; Messrs. Lockwood & Co. for extracts from ‘ Curiosities of Science,’ by John Timbs, Esq.;

Messrs. Blackie & Son, for extracts from the 'Comprehensive History of England,' by C. Macfarlane, Esq. and Rev. T. Thomson; Messrs. Griffin & Co. for extracts from 'History of England,' by G. Craik, Esq.; R. Hardwicke, Esq. for extract from 'Lectures on Food,' by Dr. Lankester; Messrs. Blackwood & Co. for extracts from 'Chemistry of Common Life,' by Professor Johnston, 'Journal of the Discovery of the Sources of the Nile,' by Captain Speke, 'The War in the Crimea,' by A. Kinglake, Esq.; Messrs. Allen & Co. for extract from the 'Russians at Home,' by Sutherland Edwards, Esq.; Messrs. Walton & Maberly, for extracts from 'Familiar Lectures on Chemistry,' by Dr. Liebig, and the 'Museum of Science of Art,' by Dr. Lardner; Messrs. Bradbury & Evans, for extracts from the 'Popular History of England,' by C. Knight, Esq.; and Messrs. Longmans & Co., and the authors and proprietors, for extracts from 'The History of Civilisation in England,' by H. T. Buckle, Esq.; 'The History of England,' by J. A. Froude, Esq., 'The Tropical World,' by Dr. Hartwig, 'The Habits and Instincts of Animals,' by W. Swainson, Esq., 'The Sandwich Islands,' by Manley Hopkins, Esq., 'The Laboratory of Chemical Wonders,' by Dr. Piesse, and 'The Recreations of a Country Parson,' by A. K. H. B.

ERRATA.

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THE ADVANCED LESSON BOOK.

THE DRUIDS.

(From 'Old England,' by Charles Knight.)

<p><i>Dru'-ids, The priests and teachers of the ancient Britons</i> <i>Gaul, the ancient name of France</i> <i>ex-pli'-cit, plain, clear</i> <i>in'-ter-dict, to forbid; a decree forbidding the performance of certain actions</i> <i>Sal'-rum, the Roman name of Salisbury</i> <i>Sil'-ches-ter, a Roman city in the West of England, not now in existence</i> <i>dis-sem'i-na-tor, one who makes anything known</i> <i>con-cil'-i-a-ted, reconciled</i></p>	<p><i>ru'-di-ments, the first principles of an art or science</i> <i>un-scrup'-u-lous, not caring whether one's actions are right or wrong</i> <i>pro-pl'-itious, favourable</i> <i>Di-od'-o-rus Sic'-u-lus, an historian of Sicily who wrote a history of Egypt, Persia, Syria, Media, Greece, Rome, and Carthage, B.C. 44</i> <i>Am-mi-a'-nus Mar-cel-li'-nus, a Roman soldier and historian</i></p>
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THE account which Julius Cæsar gives of the Druids of Gaul, marked as it is by his usual clearness and sagacity, may be received without hesitation as a description of the Druids of Britain; for, he says, the system of Druidism is thought to have been formed in Britain, and from thence carried over into Gaul; and now those who wish to be more accurately versed in it for the most part go thither (i.e. to Britain) in order to become acquainted with it. Nothing can be more explicit than his account of the mixed office of the Druids: 'They are the ministers of sacred things; they have the charge of sacrifices, both public and private; they give directions for the ordinances of religious worship. A great number of young men resort to them for the purpose of instruction in their system, and they are held in the highest reverence. For it is they who determine most disputes, whether of the affairs of the state or of individuals: and if any crime has been committed, if a man has been slain, if there is a contest concerning an inheritance or the boundaries of their lands, it is the Druids who settle the matter: they fix rewards and punishments: if anyone, whether in an individual or public capacity, refuses to abide by their sentence, they forbid him to come to their sacrifices. This punishment is among them very severe; those on whom the

interdict is laid are accounted among the unholy and accursed ; all fly from them, and shun their approach and their conversation, lest they should be injured by their very touch ; they are placed out of the pale of the law, and excluded from all offices of honour.' After noticing that a chief Druid, whose office is for life, presides over the rest, Caesar mentions a remarkable circumstance which at once accounts for the selection of such a spot as Sarum Plain for the erection of a great national monument, a temple, and a seat of justice :—These Druids hold a meeting at a certain time of the year in a consecrated spot in the country of the Carnutes (people in the neighbourhood of Chartres), which country is considered to be in the centre of all Gaul. Hither assemble all from every part who have a litigation, and submit themselves to their determination and sentence. At Stonehenge, then, we may place the seat of such an assize. There were roads leading direct over the plains to the great British towns of Winchester and Silchester. Across the plain, at a distance not exceeding twenty miles, was the great temple and Druidical settlement of Avebury. The town and hill-fort of Sarum was close at hand. Over the dry chalky downs, intersected by a few streams easily forded, might pilgrims resort from all the surrounding country. The seat of justice, which was also the seat of the highest religious solemnity, would necessarily be rendered as magnificent as a rude art could accomplish. Stonehenge might be of a later period than Avebury, with its mighty circles and long avenues of unhewn pillars ; but it might also be of the same period,—the one distinguished by its vastness, the other by its beauty of proportion. The justice executed in that judgment-seat was, according to ancient testimony, bloody and terrible. The religious rites were debased into the fearful sacrifices of a cruel idolatry. But it is impossible not to feel that at the bottom of these superstitions there was a deep reverence for what was high and spiritual : that not only were the Druids the instructors of youth, but the preservers and disseminators of science, the proclaimers of an existence beyond this finite and material world—idolaters, but nevertheless teaching something nobler than what belongs to the mere senses, in the midst of their idolatry. We give entire what Caesar says of the religious system of this remarkable body of men :—

'It is especially the object of the Druids to inculcate this—that souls do not perish, but after death pass into other bodies ; and they consider that by this belief more than anything else men may be led to cast away the fear of death, and to become courageous. They discuss, moreover, many points concerning the heavenly bodies and their motion, the extent of the universe and the world, the nature of things, the influence and ability

of the immortal gods; and they instruct the youth in these things.

'The whole nation of the Gauls is much addicted to religious observances, and, on that account, those who are attacked by any of the more serious diseases, and those who are involved in the dangers of warfare, either offer human sacrifices or make a vow that they will offer them; and they employ the Druids to officiate at these sacrifices; for they consider that the favour of the immortal gods cannot be conciliated unless the life of one man be offered up for that of another: they have also sacrifices of the same kind appointed on behalf of the state. Some have images of enormous size, the limbs of which they make of wicker-work, and fill with living men, and, setting them on fire, the men are destroyed by the flames. They consider that the torture of those who have been taken in the commission of theft or open robbery, or in any crime, is more agreeable to the immortal gods; but when there is not a sufficient number of criminals, they scruple not to inflict this torture on the innocent.

'The chief deity whom they worship is Mercury; of him they have many images, and they consider him to be the inventor of all arts, their guide in all their journeys, and that he has the greatest influence in the pursuit of wealth and the affairs of commerce. Next to him they worship Apollo and Mars, and Jupiter and Minerva; and nearly resemble other nations in their views respecting these—as that Apollo wards off diseases, that Minerva communicates the rudiments of manufactures and manual arts, that Jupiter is the ruler of the celestials, that Mars is the god of war. To Mars, when they have determined to engage in a pitched battle, they commonly devote whatever spoil they may take in the war. After the contest they slay all living creatures that are found among the spoil; the other things they gather into one spot. In many states, heaps raised of these things in consecrated places may be seen: nor does it often happen that anyone is so unscrupulous as to conceal at home any part of the spoil, or to take it away when deposited; a very heavy punishment with torture is denounced against that crime. All the Gauls declare that they are descended from Father Dis (or Pluto), and this, they say, has been handed down by the Druids: for this reason they distinguish all spaces of time, not by the number of days, but of nights; they so regulate their birth-days, and the beginning of the months and years, that the days shall come after the nights.'

The precise description which Cæsar has thus left us of the religion of the Druids—a religion which, whatever doubts may have been thrown upon the subject, would appear to have been the prevailing religion of ancient Britain, from the material

monuments which are spread through the country, and from the more durable records of popular superstitions—is different in some particulars which have been supplied to us by other writers.

According to Cæsar, the Druids taught that the soul of man did not perish with his perishable body, but passed into other bodies. But the language of other writers, Mela, Diodorus Siculus, and Ammianus Marcellinus, would seem to imply that the Druids held the doctrine of the immortality of the soul as resting upon a nobler principle than that described by Cæsar. They believed, according to the express statement of Ammianus Marcellinus, that the future existence of the spirit was in another world. The substance of their religious system, according to Diogenes Laertius, was comprised in their three precepts—to worship the gods, to do no evil, and to act with courage. It is held by some that they had a secret doctrine for the initiated, whilst their ritual observances were addressed to the grosser senses of the multitude; and that this doctrine was, the belief in one God. Their veneration for groves of oak and for sacred fountains was an expression of that natural worship which sees the source of all good in the beautiful forms with which the earth is clothed. The sanctity of the mistletoe, the watchfires of spring and summer and autumn, traces of which observances still remain amongst us, were tributes to the bounty of the All-giver, who alone could make the growth, the ripening, and the gathering of the fruits of the earth propitious.

The sun and the moon regulated their festivals, and there is little doubt formed part of their outward worship. An astronomical instrument found in Ireland is held to represent the moon's orbit and the phases of the planets. They worshipped, too, according to Cæsar, the divinities of Greece and Rome, such as Mars and Apollo; but Cæsar does not give us their native names. He probably found ascribed to these British gods like attributes of wisdom and of power as those of Rome, and so gave them Roman names. Other writers confirm Cæsar's account of their human sacrifices. This is the most revolting part of the Druidical superstition. The shuddering with which those who live under a pure revelation must regard such fearful corruptions of the principle of devotion, which in some form or other seems an essential part of the constitution of the human faculties, produced this description of Stonehenge from the pen of a laborious and pious antiquary, Mr. King:—'Although my mind was previously filled with determined aversion and a degree of horror, on reflecting upon the abominations of which this spot must have been the scene, and to which it even gave occasion, in the later periods of Druidism, yet it was impossible not to be struck, in the still of the evening, whilst the moon's

pale light illumined all, with a reverential awe at the solemn appearance produced by the different shades of this immense group of astonishing masses of rock, artificially placed, impending overhead with threatening aspect, bewildering the mind with the almost inextricable confusion of their relative situations with respect to each other, and from their rudeness as well as from their prodigious bulk, conveying at one glance all the ideas of stupendous greatness that could well be assembled together.' And yet the determined aversion and degree of horror thus justly felt, and strongly expressed, might be mitigated by the consideration that in nations wholly barbarous the slaughter of prisoners of war is indiscriminate, but that the victim of the sacrifice is the preserver of the mass.

If the victims thus slain on the Druidical altars were culprits sacrificed to offended justice, the blood-stained stone of the sacred circle might find a barbarous parallel in the scaffold and the gibbet of modern times. Even such fearful rites, if connected with something nobler than the mere vengeance of man upon his fellows, are an advance in civilization, and they are not wholly inconsistent with that rude cultivation of our spiritual being which existed under the glimmerings of natural impulses, before the clear light of heaven descended upon the earth.

SIMPLE PROPORTION.

- (1) If 75 yards of calico cost £25, what would 150 yards cost?
- (2) If the cost of 72 loads of hay be £190, what would be the cost of 96 loads?
- (3) How much will 28 yards of velvet cost, if 16 yards cost £7 10s. 6d.?
- (4) Find the value of 12 sacks of potatoes at the rate of £2 12s. 6d. for 8 sacks.
- (5) What will be the cost of 176 sheep at the rate of £330 for 132 sheep?

SPARROWS.

(From the 'History of Birds,' by Bishop Stanley.)

in-tre-plid'-i-ty, fearlessness
 ex-ult-a'-tion, joy, transport
 re-sort' (n.), a place much frequented
 sloop, a vessel having only one mast
 ru'-di-ments, roots, first elements
 plur'-mage, feathers

for'-age, to plunder, to search for food
 pi-rat'-i-cal, like a pirate, committing a robbery
 en-sue', to follow
 trans-ac'-tion, a deed, an event
 dis-con'-so-late, without comfort, hopeless

It is often remarked, what impudent birds are London sparrows! and not without reason. Born and bred in the bustle of the town, they must either live and jostle with the crowd, or look

down from the housetops and die of hunger. Naturally enough, they prefer the former; and every one of our London readers will, we are sure, testify to the cool intrepidity with which this familiar bird will pounce upon a bit of bread or some other tempting morsel, which happens to catch his eye upon the pavement, and with what triumph and exultation he bears it off to his mate seated on some window-sill or coping-stone above, or followed, perhaps, by three or four disappointed companions who were a moment too late in seizing the spoil. Then for her nest:—while other birds must select their own accustomed spots, the similar tree or bush, the same materials, &c., the sparrow, like a bird who knows the world, is everywhere at home, and ready to establish himself wherever chance may happen to place him. If he lives remote from towns and cities and the habitations of men, a tree answers his purpose, and a comfortable nest he will there build, with the rare addition of an arched top into the bargain, which possibly he may have learned from that knowing bird, the magpie. In default of a tree or a house, a chink in a rock or a hole in a wall suits him; but, after all, the nooks and eaves of buildings are his favourite resorts; accordingly, in London, where he has his choice, he will often select droll places. Amidst the carved foliage of the capital of some Corinthian column, a projection of straws, with now and then a feather, announce a nest in preparation.

But some London sparrows aspire still higher, one pair having actually built in the lion's mouth, over Northumberland House, at Charing Cross. A still more extraordinary place was pitched upon by a north-country couple. A coal vessel from Newcastle put into Nairn, in Scotland, and while there two sparrows were frequently observed to alight on the top of the vessel's mast, while the vessel remained in port. This occasioned no great surprise to the crew; but, after putting to sea, the two sparrows were seen following the sloop, and, having come up with her, resumed their posts at the top of the mast. Crumbs of bread were scattered upon the deck with the view of enticing them down, of which they soon availed themselves; and after eating heartily, again returned to the mast-head. By the time the vessel had been two days at sea they became much more familiar, and descended boldly for the purpose of feeding. The voyage was a long one, lasting for some days; when, on reaching the river Tyne, to which they were bound, the nest, with four young ones, was carefully taken down, and being put, in the presence of the old birds, into the crevice of a ruined house on the banks of the river, they continued to rear their brood.

While thus upon the subject of young sparrows, we may direct attention to the very rapid growth of their feathers in

hot weather. On the 9th of August a young one was taken from a nest, with neither down nor feathers upon it, the rudiments only of plumage being visible under the skin, on the back of the head, and along the back; on the side of the wings the shafts of the quills had just pierced the skin. Eight days after, another young one was taken from the same nest, covered with feathers, and able to make some use of its wings. Another circumstance is worthy of notice. The old ones had adapted the food to their powers of digestion. The stomach of the first was weak, and filled almost entirely with insects, only one grain of wheat and a few of sand being found. In the second the gizzard was become vastly more muscular, and contained nine grains of wheat, whole, besides some smaller pieces, the remains of several beetles, and some larger gravel stones.

A sparrow is not only bold with regard to men, but still more so, on particular occasions, towards other birds. On the edge of a certain lawn grew a close thick bush. On this lawn, amongst others, the blackbird used to come and forage for worms. One day a person happened to be looking at a blackbird in the act of making off with a prize, when a sparrow, darting from the thick bush, instantly assailed the blackbird, and compelled him to drop the worm, of which he took immediate possession. So singular a circumstance induced the observer to look out now and then, when blackbirds came, and he frequently saw the same piratical practice adopted by the sparrow, who thus, by keeping watch in his bush, was enabled to enrich himself on the labours of the larger bird. But, notwithstanding this unfavourable feature in his character, he has been known to act with great consideration and kindness to birds requiring his good offices. In the 'Naturalist's Magazine' we find the following story in point:—'A lady, living in Chelsea, was extremely fond of birds, of which she kept a considerable number in cages. Amongst others she had a canary, which was a particular favourite; but the loudness of his note often obliged her to put him outside of her window, in some trees which were trained up in front of her house. One morning, during breakfast, when the cage was there placed, a sparrow was observed to fly round about it, then perch upon the top and twitter to the bird within, between whom and itself a sort of conversation seemed to ensue. After a few moments he flew away, but returned in a short time, bearing a worm or small grub in his bill, which he dropped into the cage, and immediately flew away. Similar presents were received day after day, at the same time, by the canary, from his friend the sparrow, with whom at length he became so intimate that he very often received the food thus brought into his own bill from that of the sparrow. The circumstance attracted the

notice of the lady's neighbours, who often watched these daily visits; and some of them, to try the extent of the sparrow's kindness, also hung their birds out at the window, when they found them also fed; but the first and longest visit was always paid by the sparrow to his original friend the canary.

'Though thus intimate and social with his own kind, it was observed that this sparrow was exceedingly shy and timid with respect to human beings; for, though many were witnesses to the above, they were obliged to keep at a distance, and use great caution, otherwise he immediately flew away. This attention was carried on throughout the summer, and extended to the beginning of autumn, when the visits entirely ceased, whether intentionally on the part of the sparrow, or that he met with some accident, could not be ascertained.'

That they will attend to their young far beyond the usual period, in case of necessity, the following anecdote will prove, though we believe many, if not most birds, will do the same under similar circumstances. The experiment may be easily tried, by slightly tying the wings of young birds, when nearly fledged, or confining them by a thread to the bottom of the nest, taking care not to injure them. A pair of sparrows, which had built in the thatched roof of a house, were observed to continue their regular visits to the nest long after the time when the young birds ought naturally to have taken flight. This unusual circumstance continued throughout the year; and, in the winter a gentleman who had all along observed them, determined on finding out the cause. He therefore placed a ladder, and, on mounting found one of the young ones detained a prisoner by means of a string, or scrap of worsted, which formed part of the nest, having become accidentally twisted round its leg. Being thus disabled from procuring its own living, it had been fed by the continued exertions of the parents.

An unfortunate sparrow, who had also been made prisoner in his own nest, met with a very different fate, being actually killed, instead of preserved, by the over-zealous kind attentions of his mate. The case occurred in the spring of 1818, in Surrey. The pair were in search of a place for building their nest; and the male bird, finding a tempting hole among the tiles of the roof, got into it; unfortunately, he became entangled in the broken mortar, and could not force his way back. The female saw his situation, and after flying backwards several times, twittering, and apparently in great distress, attempted to pull him out. Several birds were attracted by the accident, and came fluttering round, but were beaten off by the hen sparrow. She then redoubled her own efforts to get him out, and seizing his beak above the nostrils with her own beak, pulled it so hard that she killed him. She did not appear,

however, aware of the mischief she had done, but continued pulling at the dead body of the unfortunate bird, with as much perseverance as if it had been alive. She was at length driven away by a person who had seen the whole transaction, and with some difficulty extricated the dead bird. Its head was dreadfully mangled, and the beak of the hen had evidently penetrated the brain. About an hour afterwards, a sparrow, supposed to be this hen, was observed sitting on the very spot where the accident had happened, crouched together, with her feathers all standing up so as to give her the appearance of a ball, conveying a perfect idea of disconsolate suffering.

SIMPLE PROPORTION.

- (1) How much will 27 men earn at the rate of £36 14s. 6d. for 18 men?
- (2) If 102 cwt. of oats cost £42 1s. 6d., what will be the cost of 238 cwt?
- (3) What will be the cost of 63 yards of cloth if 18 yards cost £5 19s. 7½d.
- (4) If 230 workmen can do a piece of work in 18 days, working 12 hours daily, in what time can 120 workmen, working at the same rate, do it?
- (5) If 81 lbs. of coffee cost £6 2s. 6½d., what will be the cost of 99 lbs.?

SANCHO PANZA AS GOVERNOR OF BARATARIA.

(From 'Don Quixote,' by Miguel de Cervantes Saavedra.)

ter'-ri-tor-y, land, district
 in'-tric-ate, entangled, not plain
 Don, a Spanish title of honour
 prith'-ee, I pray thee
 knave, originally, a servant; now, a rogue
 e'-quity, justice, fairness
 de-fend'-ant, one against whom a com-
 plaint at law is made
 plaint'-iff, one who makes a complaint at
 law
 ad'-ver-sar-y, an enemy, an opponent
 for-swear', to swear falsely

con-jec'-ture, to guess
 re'-gis-ter, to keep an account in writing
 sump'-tu-ous, rich, grand
 grav'-i-ty, seriousness
 pre-ju-di'-cial, injurious
 Hip-po'-cra-tes, an ancient Greek phy-
 sician, who cured the Athenians at a
 time of pestilence
 aph'-o-rism, a maxim, a general rule
 ab-sit' (Lat.), let it be absent
 nu'-tri-ment, food, nourishment

[Cervantes, the most renowned of Spanish writers, was born in 1547. His chief work, the 'History of Don Quixote,' is a satire on knight-errantry, which was in great favour in the West of Europe at this period, and particularly in Spain. Cervantes died in poverty in 1616. 'Don Quixote' has been translated into many languages. The best English translation, from which the extract is taken, was made by Motteux, a Frenchman, in 1706.]

(Sancho Panza was the squire or attendant of Don Quixote.)

AFTER having travelled a certain distance, Governor Sancho, with his attendants, came to a town that had about a thousand inhabitants, and was one of the best in the duke's territories.

They gave him to understand that the name of the place was the island of Barataria. As soon as he came to the gates, the magistrates came out to receive him, the bells rung, and all the people gave general demonstrations of joy. They then delivered him the keys of the gates, and received him as perpetual governor of the island of Barataria.

Next they carried him to the court of justice; where, when they had placed him in his seat, 'My lord governor,' said the duke's steward to him, 'it is an ancient custom here, that he who takes possession of this famous island must answer some difficult and intricate question that is propounded to him; and, by the return he makes, the people feel the pulse of his understanding, and, by an estimate of his abilities, judge whether they ought to rejoice or to be sorry for his coming.'

All the while the steward was speaking, Sancho was staring on an inscription in large characters on the wall over against his seat; and, as he could not read, he asked what was the meaning of that which he saw painted there upon the wall. 'Sir,' said they, 'it is an account of the day when your lordship took possession of this island; and the inscription runs thus, "This day the Lord Don Sancho Panza took possession of this island, which may he long enjoy."' 'And who is he,' asked Sancho, 'whom they call Don Sancho Panza?' 'Your lordship,' answered the steward; 'for we know of no other Panza in this island but yourself, who now sits in this chair.' 'Well, friend,' said Sancho, 'pray take notice that Don does not belong to me, nor was it borne by any of my family before me. Plain Sancho Panza is my name; my father was called Sancho, my grandfather Sancho, and all of us have been Panzas, without any Don or Donna added to our name. Now do I already guess your Dons are as thick as stones in this island. But it is enough that Heaven knows my meaning; if my government happens to last but four days to an end, it shall go hard but I will clear the island of those swarms of Dons, that must needs be as troublesome as so many gnats. Come, now for your question, good Mr. Steward; and I will answer it as well as I can, whether the town be sorry or pleased.'

At this instant two men came into the court, the one dressed like a country fellow, the other looked like a tailor, with a pair of shears in his hand. 'If it please you, my lord,' cried the tailor, 'this honest man came to my shop yesterday; for, saving your presence, I am a tailor, and free of my company, too; so, my lord, he shewed me a piece of cloth. "Sir," quoth he, "is there enough of this to make a cap?" Whereupon I measured the stuff and answered, "Yes." Now, as I imagined, do you see, he could not but imagine (and perhaps he imagined right enough), that I had a mind to cabbage some

of his cloth—judging hard of us honest tailors. “Prithee,” quoth he, “look there be not enough for two caps?” Now I smelt him out, and told him there was. Whereupon the old knave, going on to the same tune, bid me look again, and see whether it would not make three; and at last if it would not make five? I was resolved to humour my customer, and said it might; so we struck a bargain. Just now the man is come for his caps, which I gave him; but he refuses to pay me for my work; and now he will have me give him his cloth again, or pay him for it.’ ‘Is this true, honest man?’ said Sancho to the former. ‘Yes, if it please you,’ answered the fellow; ‘but pray let him shew the five caps he has made me.’ ‘With all my heart,’ cried the tailor; and with that, pulling his hand from under his cloak, he held up five little tiny caps, hanging upon his four fingers and thumb, as upon so many pins. ‘There,’ quoth he, ‘you see the five caps this good gaffer asks for; and, on my conscience, I have not wronged him of the least shred of his cloth; and let any workman be judge.’ The sight of the caps and the oddness of the cause set the whole court a-laughing. Only Sancho sat gravely considering a while; and then, ‘Methinks,’ said he, ‘this suit may be decided without any more ado, with a great deal of equity; and therefore the judgment of the court is, that the tailor should lose his making and the countryman his cloth, and that the caps be given to the poor prisoners; and so let there be an end of the business.’ If this sentence provoked the laughter of the whole court, the next no less raised their admiration. For after the governor’s order was executed, two old men appeared before him; one of them with a large cane in his hand, which he used as a staff. ‘My lord,’ said the other, who had none, ‘some time ago, I lent this man ten gold crowns, to do him a kindness, which money he was to repay me on demand. I did not ask him for it again for a good while, lest it should prove inconvenient. However, perceiving that he took no care to pay me, I have asked him for my due; nay, I have been forced to dun him hard for it. But still, he did not only refuse to pay me again, but denied he owed me anything, and said that if I lent him so much money he certainly returned it. Now, because I have no witness of the loan, nor he of the pretended payment, I beseech your lordship to put him to his oath; and if he will swear he has paid me, I will freely forgive him before God and the world.’ ‘What say you to this, old gentleman with the staff?’ asked Sancho. ‘Sir,’ answered the old man, ‘I own he lent me the gold; and, since he requires my oath, I beg you will be pleased to hold down your rod of justice, that I may swear upon it how I have honestly and truly returned him his money: Thereupon the governor held down his rod, and in the mean-

time the defendant gave his cane to the plaintiff to hold, as if it hindered him, while he was to make a cross and swear over the judge's rod. This done, he declared it was true the other had lent him ten crowns, but that he had really returned him the same sum into his own hands. The great governor, hearing this, asked the creditor what he had to reply. He made answer that, since his adversary had sworn it, he was satisfied; for he believed him to be a better Christian than offer to forswear himself, and that perhaps he had forgotten he had been repaid. Then the defendant took his cane again, and having made a low obeisance to the judge, was immediately leaving the court; which, when Sancho perceived, reflecting on the passage of the cane, and admiring the creditor's patience, after he had thought awhile, he suddenly ordered the old man with the staff to be called back. 'Honest man,' said Sancho, 'let me look at that cane a little; I have a use for it.' 'With all my heart, Sir,' answered the other, 'here it is;' and with that he gave it him. Sancho took it, and, giving it to the other old man, 'There,' said he, 'go your ways, and heaven be with you, for now you are paid.' 'How so, my lord?' cried the old man; 'do you judge this cane to be worth ten golden crowns?' 'Certainly,' said the governor, 'or else I am the greatest dunce in the world. And now you shall see whether I have not a headpiece fit to govern a whole kingdom upon a shift.' This said, he ordered the cane to be broken in open court; which was no sooner done than out dropped the ten crowns. All the spectators were amazed, and began to look on their governor as a second Solomon. They asked him how he could conjecture that the ten crowns were in the cane. He told them that he had observed how the defendant gave it to the plaintiff to hold while he took his oath, and then swore he had truly returned him the money into his own hands, after which he took his cane again from the plaintiff; this considered, it came into his head that the money was lodged within the reed. From whence may be learned, that though sometimes those that govern are destitute of sense, yet it often pleases God to direct them in their judgment. The two old men went away, the one to his satisfaction, the other with shame and disgrace; and the beholders were astonished, inasmuch that the person who was commissioned to register Sancho's words and actions, and observe his behaviour, was not able to determine whether he should give him the character of a wise man, instead of that of a fool, which he had been thought to deserve.

The history informs us that Sancho was conducted from the court of justice to a sumptuous palace, where, in a spacious room, he found the cloth laid, and a magnificent entertainment prepared. As soon as he entered, the wind music played, and

four pages waited on him with water for washing his hands, which he did with a great deal of gravity. The instruments ceasing, Sancho sat down at the upper end of the table; for there was no seat but there, and the cloth was only laid for one. A certain personage, who afterwards appeared to be a physician, came and stood at his elbow, with a whalebone wand in his hand. Then they took off a curious white cloth that lay over the dishes on the table, and discovered a great variety of fruit and other eatables. One that looked like a student said grace; a page put a laced cloth under Sancho's chin; and another set a dish of fruit before him. But he had hardly put one bit into his mouth before the physician touched the dish with his wand, and then it was taken away by a page in an instant. Immediately another with meat was put in the place; but Sancho no sooner offered to taste it, than the doctor, with the wand, conjured it away as fast as the fruit. Sancho was amazed at this sudden removal, and, looking about him on the company, asked them 'Whether the dinner was only to show off their sleight of hand.' 'My Lord Governor,' answered the physician, 'you are to eat here no otherwise than according to the use and custom of other islands where there are governors. I am a doctor of physic, my lord, and have a salary allowed me in this island for taking charge of the governor's health; and I am more careful of it than of my own, studying night and day his constitution, that I may know what to prescribe when he falls sick. Now the chief thing I do is, to attend him always at his meals, to let him eat what I think convenient for him, and to prevent his eating what I imagine to be prejudicial to his health. Therefore I ordered the fruit to be taken away, because it is too cold and moist; and the other dish because it is as much too hot and overseasoned with spices, which are apt to increase thirst; and he that drinks much destroys and consumes the radical moisture, which is the fuel of life.' 'So, then,' quoth Sancho, 'this dish of roasted partridges here can do me no manner of harm.' 'Hold,' said the physician, 'the Lord Governor shall not eat of them while I live to prevent it.' 'Why so?' cried Sancho. 'Because,' answered the doctor, 'our great master, Hippocrates, the north star and luminary of physic, says in one of his aphorisms, "*Omnis saturatio mala, perdicis autem pessima*;" that is, All repletion is bad, but that of partridges is worst of all.' 'If it be so,' said Sancho, 'let Mr. Doctor see which of all these dishes on the table will do me the most good and least harm, and let me eat of that, without having it whisked away with his wand. For, by my hopes and the pleasures of government, as I live, I am ready to die with hunger; and not to allow me to eat my victuals (let Mr. Doctor say what he will) is the way to shorten my life, and

not to lengthen it.' 'Very true, my lord,' replied the physician; 'however, I am of opinion you ought not to eat of these rabbits; nor would I have you taste that veal. Indeed, if it were neither roasted nor pickled, something might be said; but as it is, it must not be.' 'Well, then,' said Sancho, 'what think you of that huge dish yonder, that smokes so? I take it to be an olla podrida; and that being a hodge-podge of so many sorts of victuals, sure I cannot but light upon something there that will be both wholesome and pleasant.' 'Absent,' cried the doctor, 'far be such an ill thought from us; no diet in the world yields more nutriment than the mishmashes do. Simple medicines are generally allowed to be better than compounds; for, in a composition there may happen a mistake by the unequal proportion of the ingredients; but simples are not subject to that accident. Therefore, what I would advise at present, as a fit diet for the governor, for the preservation and support of his health, is a hundred of small wafers and a few thin slices of marmalade, to strengthen his stomach and help digestion.' Sancho, hearing this, leaned back upon his chair, and looking earnestly in the doctor's face very seriously asked him what his name was and where he had studied. 'My lord,' answered he, 'I am called Doctor Pedro Rezio de Agüero. The name of the place where I was born is Tirteafuera, and lies between Caraquel and Almodabar del Campo, on the right hand; and I took my degree of doctor in the University of Ossuna.' 'Hark you,' said Sancho, in a mighty chafe, 'Mr. Doctor Pedro Rezio de Agüero, take yourself away! Avoid the room this moment, or assuredly I'll get me a good cudgel, and, beginning with your carcase, will so belabour and rib-roast all the physic-mongers in the island, that I will not leave therein one of the tribe,—of those I mean that are ignorant quacks; for as for learned and wise physicians, I will make much of them, and honour them like so many angels. Once more, Pedro Rezio, I say, get out of my presence! Avaunt! or I will take the chair I sit upon, and comb your head with it to some purpose, and let me be called to an account about it when I give up my office. I do not care; I will clear myself by saying I did the world good service in ridding it of a bad physician, the plague of a commonwealth. Let me eat, I say, or let them take their government again; for an office that will not afford a man his victuals is not worth two horse beans.'

SIMPLE PROPORTION.

- (1) Bought 120 tons 2 cwt. 2 qrs. of coal for £75 1s. 6½d., how much is that for 6 cwt. 2 qrs.?
- (2) How much are 28 ells 2 qrs. of cloth worth at the rate of £5 11s. 6d. for 12 ells 1 qr.?

- (3) How many coats of the same size can be made out of 78 yards of cloth, if 12 are made out of 36 yards?
- (4) The rent of a field of 3 a. 3 r. is £4 6s. 8d.; what will be the rent of a field, at the same rate, of 7 a. 2 r. 30 p.?
- (5) Find the time a railway train will be going from London to Shrewsbury, 130 miles, travelling at the rate of 76 miles in 3 hours?

YEDO.

(From 'A Visit to Japan and China,' by Robert Fortune.)

Yed'-o or Jed'-do, the capital of Japan,
is SE. of the island of Nippon
fas'-ci-na-ting, charming
an-i-ma'-tion, liveliness
dec'-or-a-tive, ornamental
det'-ri-ment, injury
pro-fu'-sion, great abundance

in-val'-u-a-ble, of too great va'l'ue to have
a price set on it
ven'-i-son, the flesh of deer
pre'-ju-dice, an opinion formed without
an opportunity of judging
un'-du-la-ting, up and down like waves
of the sea

THE streets were much wider and cleaner than those of the Chinese towns; but the contents of the shops appeared to be of little value. One must, however, bear in mind that Yedo is not a manufacturing or trading town, in the usual sense in which the term is used. Hence, perhaps, I ought to have expected to see only the necessities, or perhaps a few of the luxuries of life, exhibited in the shops here. Silk and cotton shops were numerous, and, if they did not obtain custom it was not for want of the use of means. Men and boys were stationed in front of the doors, trying all their arts to induce the passers-by to go in and spend their money. Lacquer-ware, bronzes, and porcelain were exhibited in abundance, as were also umbrellas, pipes, toys, and paper made up into every conceivable article. . . All sorts of toys were abundant, and some of them were most ingenious and pretty. There were glass balls with numerous little tortoises inside them, whose heads, tails, and feet were in constant motion; humming-tops with a number of trays inside, which all came out and spun round on the table when the top was set in motion; and a number of funny things in boxes, like little bits of wood shavings, which perform the most curious antics when thrown into a basin containing water. Dolls of the most fascinating kind, with large, shaved, bobbing heads, crying out most lustily when pressed upon the stomach, were also met with in cart-loads. One little article, so small one could scarcely see it, when put upon hot charcoal, gradually seemed to acquire life and animation, and moved about for all the world like a brilliant caterpillar. This large trade in toys shows us how fond the Japanese are of their children. . . .

I may here mention, in passing, that Japanese paper is made chiefly out of the bark of the paper mulberry. It is per-

ticularly suited for decorative purposes, such as the papering of rooms. It has a glossy, silky, and comfortable appearance, and many of the patterns are extremely chaste and pretty. The fan pattern, which looked as if fans had been thrown all over the surface, used to be much admired by the foreign residents. For some reason it is made in very small sheets, which would render it rather inconvenient to our paper-hangers. This, however, is no detriment in Japan, where labour is cheap. Japanese oil-paper is of very superior quality, and is used for a variety of purposes. For a very small sum one can be clothed in a 'Mackintosh' coat and trousers capable of keeping out any amount of rain. As a wrapper to protect silk goods and other valuable fabrics from wet and damp, it is invaluable, and, owing to its great strength, it is often used instead of a tin or lead casing. Despatch-boxes, looking like leather, and very hard and durable, are also made of paper, and so are letter-bags, purses, cigar-cases, umbrellas, and many other articles in daily use. In addition to those purposes to which paper is applied in western countries, in Japan it is used for windows instead of glass, for the partitions of rooms instead of lath and plaster, for fans and fan-cases, for twine, and in a variety of other ways.

Articles used as food were displayed in abundance in all the streets of the commercial quarter. The vegetables and fruits of the country, such as I have named elsewhere, were in profusion everywhere, and apparently cheap. The bay supplies the good people of Yedo with excellent fish, and consequently the fishmonger was duly represented amongst the shopkeepers, where his wares could be purchased either dead or alive, fresh or salted. Butchers' shops were also observed as we rode along, showing that the Japanese do not live on vegetables and fish only. It is true that in these shops we did not observe any beef, for the Japanese do not kill their bullocks and eat them as we do; and, as the sheep is not found in the country, we, of course, could not see any mutton. Venison, however, was common, and monkeys were observed in several of the shops. I shall never forget the impression produced upon me when I saw the latter hanging up in front of a butcher's door. They were skinned, and had a most uncomfortable resemblance to the members of the human family. I dare say the Japanese consider the flesh of the monkey very savoury, but there is no accounting for prejudices and tastes; and I must confess that I must have been very hungry indeed before I could have dined off these human-looking monkeys.

In our ride through the town we remarked a large number of fire-proof houses, or godowns, for the protection of money or valuable goods in case of fire. These have thick walls of mud

and stone, and are most useful in a country like this, where fires occur so frequently. Wooden watch-towers were also numerous in all parts of the city. These are posts of observation, from which a fire can be observed at a distance, and an alarm given. Buckets of water were seen in every street, and frequently on the tops of the houses; and a kind of fire police are continually on the watch by night and by day, ready to give instant notice and assistance. . . . Riding along the banks of the river, we soon found ourselves nearly clear of houses, and in the country. As we looked back over the river, the city of Yedo, with its temples, watch-towers, and undulating wooded hills, lay spread out before us, and formed a picture of striking beauty. Nearly all the land where we were was one vast garden; or, to speak more correctly, it was covered with tea-gardens and nurseries. There were hedges of single camelias, white and red, and China roses, all in full bloom, although it was now late in November. Many evergreen trees were there, clipped into fanciful shapes; and the indispensable flowering plums and cherries were in great abundance, although now leafless, and having put on their wintry garb.

We paid a visit to a number of tea houses and gardens; and, from the way in which they were arranged and planned, no doubt they are patronised by thousands during the spring and summer seasons, when picnic-loving and pleasure-seeking Yedoites go out to enjoy themselves. Everywhere we were politely received, and tea was pressed upon us by the proprietors of the gardens. . . . On our way home I observed that our road was strewn with straw shoes, which had been worn by men and horses. All the horses wear shoes of straw, which, when worn out, are replaced by others, the old ones being left on the road where they are cast off.

SIMPLE PROPORTION.

- (1) If 14 men can mow a field in 11 days of 12 hours each, in how many days of the same length could 32 men mow it, working at the same rate?
- (2) What will be the carriage of 4 tons 2 qrs. 14 lbs. of coal for 35 miles, at the rate of £6 17s. 6½d. for 8 tons 17 cwt. 1 qr. 14 lbs. for the same distance?
- (3) If 45 pieces of cloth, each containing 24 yards, cost £96 17s. 6½d., what will be the cost of 3 pieces of the same quality, each containing 16 yards?
- (4) What quantity of oats can be bought for £287 2s., at the rate of 10s. 6d. for 1 bus. 3 pecks?
- (5) A garrison of 960 men had provisions enough to last 81 days; how long would their provisions last if they lost 144 men taken prisoners in a sortie?

ENGLAND'S FIRST MARTYR.

(Translated from Bede's 'Ecclesiastical History'.)

per-fid'i-ous, treacherous
 sac-ri-le'gi-ous, violating sacred things
 con-temn'er, a despiser
 em-bel'lish-ed, ornamented
 ad-mo-ni'tion, advice, reproof

ap-pa'rent, seeming, easily seen
 re-gen'e-ra-ted, born again
 kal'ends, the name given by the Romans
 to the first day of every month

[Diocletian was the son of a slave. He was chosen Emperor of Rome by the army A.D. 286, and died in 313. At this period Britain was under the Roman rule.]

In the persecution of Diocletian, Emperor of Rome, Alban, being yet a Pagan, at the time when the commands of perfidious princes raged against Christians, gave entertainment in his house to a certain clergyman, flying from the persecutors. Observing him wholly addicted to continual prayer, and watching day and night; on a sudden the divine grace shining on him, he began to admire his example of faith and piety, and, being leisurely instructed by his wholesome admonitions, casting off the darkness of idolatry, he became a Christian in all sincerity of heart. The aforesaid clergyman, having been some days entertained by him, it came to the ears of the wicked prince that the confessor of Christ, to whom the place of martyrdom had not been yet appointed, was concealed at Alban's house. Whereupon he presently ordered soldiers to make a strict search after him. When they came to the martyr's house, St Alban immediately presented himself to the soldiers, instead of his guest and master, in his habit, or the long coat he wore, and was led bound before the judge. It happened that the judge, at the time when Alban was carried before him, was standing at the altar, and offering sacrifice to devils. When he saw Alban, being much enraged for that he had presumed of his own accord to put himself into the hands of the soldiers, and run that danger for his guest, he commanded him to be dragged to the images of devils, before which he stood, saying, 'Because you have chosen to conceal a rebellious and sacrilegious person rather than to deliver him up to the soldiers, that the contemner of the gods might suffer the penalty due to his blasphemy; you shall undergo all the punishment that was due to him, if you depart from the worship of our religion.' But St. Alban, who had voluntarily declared himself a Christian to the persecutors of the faith, was not at all daunted at the prince's threats, but being armed with the armour of the spiritual warfare, publicly declared that he would not obey his commands. Then said the judge, 'Of what family or race are you?' 'What does it concern you,' answered Alban, 'of

what stock I am ? but if you desire to hear the truth of my religion, be it known to you that I am now a Christian and addicted to Christian duties.' 'I ask your name,' said the judge, 'which tell me immediately.' 'I am called Alban by my parents,' replied he, 'and ever worship and adore the true and living God, who created all things.' Then the judge, inflamed with anger, said, 'If you will enjoy the happiness of eternal life, do not delay to offer sacrifice to the great gods.' Alban rejoined, 'These sacrifices, which by you are offered to devils, neither can they avail the subjects, nor answer the wishes or desires of those that offer up their supplications to them. On the contrary, whosoever shall offer sacrifice to these images shall receive the everlasting pains of hell for his reward.' The judge, hearing these words, and being much incensed, ordered the holy confessor of God to be scourged by the executioners, believing he might by stripes shake that constancy of his heart, on which he could not prevail by words. He being most cruelly tortured, bore the same patiently, or rather joyfully, for our Lord. When the judge perceived that he was not to be overcome by tortures, or withdrawn from the worship of the Christian religion, he ordered him to be put to death. Being led to execution, he came to the river, which was divided, at the place where the stroke was to be given him, with a wall and sand, the stream being most rapid. He there saw a multitude of persons of both sexes, and of several ages and conditions, which was doubtless assembled by divine instinct, to attend the most blessed confessor and martyr, and had so taken up the bridge on the river, that he could scarce pass over that evening. At length, almost all being gone out, the judge remained in the city without attendance. St. Alban, therefore, whose mind was possessed with an ardent devotion to arrive quickly at martyrdom, drew near to the stream, and, lifting up his eyes to heaven, the channel being immediately dried up, he perceived that the water had departed and given way for him to pass. The executioner who was to have put him to death, observing this among the rest, hastened to meet him at the place of execution, being moved by divine inspiration, and casting down the sword which he had carried, ready drawn, fell down at his feet, earnestly praying that he might rather suffer with or for the martyr whom he was ordered to execute. Whilst he of a persecutor was become a companion in the truth and faith, and the sword being laid down, there was some hesitation among the executioners, the most reverend confessor of God ascended the hill with the throng, the which decently pleasant agreeable place is about five hundred paces from the river, embellished with several sorts of flowers, or rather quite covered with them; wherein there is no part upright, or steep, nor

anything craggy, but the sides stretching out far about are levelled by nature like the sea, which of old it had rendered worthy to be enriched with the martyr's blood for its beautiful appearance. On the top of this hill, St. Alban prayed that God would give him water, and immediately a living spring broke out before his feet, the course being confined, so that all men perceived that even the stream had been subservient to the martyr. Nor could it be that the martyr should ask water, which he had not left in the river, on the high top of the hill, had he not been sensible that it was convenient. That river having performed the service, and fulfilled the devotion, returned to its natural course, leaving a testimony of its obedience. The most courageous martyr, having his head struck off, received there the crown of life, which God has promised to those that love him. But he who gave the wicked stroke was not permitted to rejoice over the deceased; for his eyes dropped upon the ground together with the blessed martyr's head. At the same time was also beheaded there the soldier, who before, through the divine admonition, refused to give the stroke to the holy confessor of God: of whom it is apparent, that though he was not regenerated by baptism, yet he was cleansed by the washing of his own blood, and rendered worthy to enter the kingdom of heaven. The judge then, astonished at the novelty of so many heavenly miracles, ordered the persecution to cease immediately, beginning to honour the death of the saints, by which he before thought they might have been diverted from the devotion of the Christian faith. The blessed Alban suffered on the tenth day of the Kalends of July, near the city of Verolam, which is now by the English nation called Uverlamacestir or Uvarlingacester, where afterwards, when peaceable Christian times were restored, a church of wonderful workmanship, and suitable to his martyrdom, was erected. In which place, there ceases not to this day the cure of sick persons, and the frequent working of wonders. At the same time suffered Aaron and Julius, citizens of Chester, and many more of both sexes in several places, who, having endured sundry torments, and their limbs torn after an unheard-of manner, sent their souls by perfect combat to the joys of the heavenly city.

SIMPLE PROPORTION.

- (1) Take 3 tons 13 cwt. 2 qrs. 1 lb. 8 oz. from 6 tons 10 cwt., and find the value of the remainder at £2 15s. for 3 qrs. 26 lbs.
- (2) If the land-tax of an estate be £22 15s. per annum, and it be charged at the rate of £2 16s. 3d. per £100, what will be the net income of the owner?
- (3) If a bankrupt has property to the amount of £340, and his debts are £1,076, what will he pay in the £?

- (4) A man lent his friend the sum of £525 15s. for 1 year 20 days; his friend would return the obligation by lending him £630 18s.: for how long should he lend this amount?
- (5) What sum must a person spend in 96 days, if he desires to save every year £75 out of an income of £600?

WONDERS OF SCIENCE.

(Written in 1855.)

(From 'The Electric Telegraph,' by Dr. Lardner.)

sig'-nal-i-sed, made remarkable	con-tem'-po-ra-ries, persons who live at
sub-ju-ga'-tion, the act of subduing	the same time
ey'-och, a fixed point of time from which	pre-ci'-sion, exactness
dates are reckoned	su-per-se'-ded, set aside
mit'-i-gate, to lessen	spon-ta'-ne-ous, of one's own accord,
con-sum'-mate, produced with the greatest	voluntary
skill, complete	sub-ser'-vi-en-cy, serviceableness, wil-
ob'-so-lete, out of use	lingness to perform any service
ce-ler'-i-ty, quickness	in-con-test'-a-bly, in a manner that
ap-pa-ra'-tus, tools or instruments	cannot be disputed
mech'-an-ism, machinery, and the art of	a-bridg'-ment, a shortening
making it	

EACH succeeding age and generation leaves behind it a peculiar character, which stands out in relief upon its annals, and is associated with it for ever in the memory of posterity. One is signalised for the invention of gunpowder, another for that of printing; one is rendered memorable by the revival of letters, another by the reformation of religion; one is marked in history by the conquests of Napoleon, another is rendered illustrious by the discoveries of Newton.

If we are asked by what characteristic the present age will be marked in future records, we answer, by the miracles which have been wrought in the subjugation of the powers of the material world to the uses of the human race. In this respect no former epoch can approach to competition with it.

The author of some of the most popular fictions of the day has affirmed, that in adapting to his purpose the results of his personal observations on men and manners, he has not unfrequently found himself compelled to mitigate the real in order to bring it within the limits of the probable. No observer of the progress of the arts of life, at the present time, can fail to be struck with the prevalence of the same character in their results, as that which compelled this writer to suppress the most wonderful of what had fallen under his eye, in order to bring his descriptions within the bounds of credibility. Many are old enough to remember the time when persons, correspondence, and merchandise were transported from place to place in this country.

by stage coaches, vans, and waggon. In those days, the fast coach, with its team of spanking blood-horses, and its bluff driver with broad-brimmed hat and drab box-coat, from which a dozen capes were pendant, who 'handled the ribbons' with such consummate art, could pick a fly from the ear of the off-leader, and turn into the gateway at Charing-cross with the precision of a geometrician, were the topics of the unbounded admiration of the traveller. Certain coaches obtained a special celebrity and favour with the public. We cannot forget how the eye of the traveller glistened when he mentioned the Brighton 'Age,' the Glasgow 'Mail,' the Shrewsbury 'Wonder,' or the Exeter 'Defiance';—the 'Age,' which made its trip in five hours, and the 'Defiance,' which acquired its fame by completing the journey between London and Exeter in less than thirty hours.

The rapid circulation of intelligence was also the boast of those times. How foreigners stared when told that the news of each afternoon formed a topic of conversation at tea-tables the same evening, twenty miles from London; and that the morning journals, still damp from the press, were served at breakfast within a radius of thirty miles, as early as the frequenters of the London clubs received them!

Now let us imagine that some profound thinker, deeply versed in the resources of science at that epoch, were to have gravely predicted that the generation existing then and there would live to see all these admirable performances become obsolete, and consigned to the history of the past; that they would live to regard such vehicles as the 'Age' and 'Defiance' as clumsy expedients, and their celerity such as to satisfy those alone who were in a backward state of civilisation!

Let us imagine that such a person were to affirm that his contemporaries would live to see a coach like the 'Defiance' making its trip between London and Exeter, not in thirty, but in five hours, and drawn, not by 200 blood-horses, but by a moderate-sized stove and four bushels of coals!

Let us further imagine the same sagacious individual to predict that his contemporaries would live to see a building erected in the centre of London, in the cellars of which machinery would be provided for the fabrication of artificial lightning, which should be supplied to order, at a fixed price, in any quantity required, and of any prescribed force; that conductors would be carried from this building to all parts of the country, along which such lightning should be sent at will; that in the attics of the same building would be provided certain small instruments like barrel-organs or pianofortes; that by means of these instruments, the aforesaid lightning should, at the will and pleasure of those in charge of them,

deliver messages at any part of Europe, from St. Petersburg to Naples; and, in fine, that answers to such messages should be received instantaneously, and by like means; that in this same building offices should be provided, where any lady or gentleman might enter at any hour, and for a few shillings send a message by lightning to Paris or Vienna, and, by waiting for a few moments, receive an answer!

Might he not exclaim after the inspired author of the book of Job:—‘Canst thou send lightnings, that they may go, and say unto thee, Here we are’ (xxxviii. 35)? But, suppose that his foresight should further enable him to pronounce that means would be invented by which any individual, in any one town or city of Europe, should be enabled to take in his hand a pencil or pen, the point of which should be in any other town or city, no matter how distant, and should, with such pen or pencil, write or delineate in such distant place such characters or designs as might please him, with as much promptitude and precision as if the paper to which these characters or designs were committed lay upon the table before him; or that an individual pulling a string at London should ring a bell at Vienna, or holding a match at St. Petersburg should discharge a cannon at Naples!

Suppose he should affirm that means would be discovered for converting charcoal into diamonds; that the light of the sun would be compelled, without the intervention of the human hand, to make a portrait or a picture, with a fidelity, truth, and precision, with which the productions of the most exalted artistic skill would not bear comparison; and that this picture should be produced and completed in its most minute details, in a few seconds—nay, even in the fraction of a second; that candles and lamps would be superseded by flame manufactured on a large scale in the suburbs of cities, and distributed for use in pipes carried under the streets, and into the houses and other buildings to be illuminated; and that the precious and other metals, being dissolved in liquids, would form themselves into the articles of ornament and use by a spontaneous process, and without the intervention of human labour!!

No authority however exalted, no attainments however profound, no reputation however respected, could have saved the individual rash enough to have given utterance to such predictions some forty years ago, from being regarded as labouring under intellectual derangement. Yet all these things have not only come to pass, but the contemplation of many of them has become so interwoven with our habits, that familiarity has blunted the edge of wonder.

Compared with all such realities, the illusions of oriental romance grow pale: fact stands higher than fiction in the

scale of the marvellous; the feats of Aladdin are tame and dull, and the slaves of the lamp yield precedence to the spirits which preside over the battery and the boiler.

Of all the physical agents discovered by modern scientific research, the most fertile in its subserviency to the arts of life is, incontestably, electricity; and of all the applications of this subtle agent, that which is transcendently the most admirable in its effects, the most astonishing in its results, and the most important in its influence upon the social relations of mankind, and upon the spread of civilisation and the diffusion of knowledge, is the electric telegraph. No force of habit, however long continued, no degree of familiarity, can efface the sense of wonder which the effects of this most marvellous application of science excites.

Being at Paris some years ago, I was engaged to share with M. Leverrier, the celebrated astronomer, and some other men of science, in the superintendence of a series of experiments to be made before committees of the Legislative Assembly and of the Institute, with the view of testing the efficiency of certain telegraphic apparatus. On that occasion, operating in a room at the Ministry of the Interior, appropriated to the telegraphs, into which wires proceeding from various parts of France were brought, we dictated a message, consisting of about forty words, addressed to one of the clerks at the railway station at Valenciennes, a distance of 168 miles from Paris. This message was transmitted in two minutes and a-half. An interval of about five minutes elapsed, during which, as it afterwards appeared, the clerk to whom the message was addressed was sent for. At the expiration of this interval the telegraph began to express the answer, which, consisting of about thirty-five words, was delivered and written out by the agent at the desk, in our presence, in two minutes. Thus, forty words were sent 168 miles, and thirty-five words returned from the same distance in the short space of four minutes and thirty seconds. But, surprising as this was, we soon afterwards witnessed in the same room a still more marvellous performance. The following experiment was prepared and performed at the suggestion and under the direction of M. Leverrier and myself :—

Two wires, extending from the room in which we operated to Lille, were united at the latter place, so as to form one continuous wire extending to Lille and back, making a total distance of 336 miles. This, however, not being deemed sufficient for the purpose, several coils of wire wrapped with silk were obtained, measuring in their total length 746 miles, and were joined to the extremity of the wire returning from Lille, thus making one continuous wire measuring 1082 miles. A message consisting of 282 words was then transmitted from one

end of the wire. A pen attached to the other end immediately began to write the message on a sheet of paper moved under it by a simple mechanism, and the entire message was written in full in the presence of the committee, each word being spelled completely and without abridgment, in fifty-two seconds, being at the average rate of five words and four-tenths per second!

By this instrument, therefore, it is practicable to transmit intelligence to a distance of upwards of 1000 miles, at the rate of 19,500 words per hour!

The instrument would, therefore, transmit to a distance of 1000 miles, in the space of an hour, the contents of about forty pages of the book now in the hands of the reader!

But it must not be imagined because we have here produced an example of the transmission of a despatch to a distance of 1000 miles, that any augmentation of that distance could cause any delay of practical importance.

Although the velocity of the electric current has not been very exactly measured, it has been established beyond all doubt that it is so great that to pass from any one point on the surface of the earth to any other, it would take no more than an inappreciable fraction of a second.

If, therefore, the despatch had been sent to a distance of 20,000 miles instead of 1000, its transmission would still have been instantaneous. Such a despatch would fly many times round the earth between the two beats of a common clock, and would be written in full at the place of its destination more rapidly than it could be repeated by word of mouth. When such statements are made, do we not feel disposed to exclaim—

‘Are such things here as we do speak about?
Or have we eaten of the insane root
That makes the reason prisoner?’

In its wildest flights the most exalted imagination would not have dared, even in fiction, to give utterance to these stubborn realities. Shakespeare only ventured to make his fairy ‘Put a girdle round the earth in forty minutes.’ To have encircled it several times in a second, would have seemed too monstrous even for Robin Goodfellow.*

SIMPLE PROPORTION.

- (1) What should be paid to a servant from August 3rd to December 7th, whose wages are at the rate of 28 guineas per annum?

* The electric telegraph to India is now complete. The statement of the Minister of Finance in Calcutta was telegraphed to England on Friday, April 7th, 1865. The newspapers in England were thus able to comment upon this statement *two days after its delivery, more than 5000 miles away*; and, of course, it would have arrived in a few minutes but for unavoidable delays at various stations in course of transmission.—EDS.

- (2) If a gentleman, after paying income tax of 1s. 6d. in the £, has £969 17s. 6d. left, what is his annual income?
- (3) A piece of gold at £4 10s. 6d. per oz. is worth £420; what will be the worth of a piece of silver of equal weight at 5s. 1d. per oz.?
- (4) How many yards of drugget $1\frac{1}{4}$ yard wide will cover 35 yards of carpet $\frac{3}{4}$ yard wide?
- (5) If 18 men, 14 women, and 10 boys can finish a piece of work in 60 days, in what time would 10 men, 18 women, and 16 boys do it, supposing a man to do twice as much as a woman, and a woman to do 3 times as much as a boy?

THE GOOD PARSON.

(From the 'Canterbury Tales,' by Geoffrey Chaucer.)

ban, to curse, to excommunicate
 un-let'-ter'd, not learned, ignorant
 ac-oom'-ber'd, encumbered, burdened
 cog- (v.), to flatter
 chaunt'-er-y, a chapel for priests to sing
 mass in
 ma-lign', evil spoken
 be-nign', kind, generous
 sith, since

mer'-ce-nar-y (n.), a hireling; one who
 fills an office merely for the sake of
 money
 joust, a mock fight
 tour'-na-ment, a mock battle
 eke, also
 wight, a person
 des-pite', injury
 cure, a clergyman's district

[Geoffrey Chaucer, the father of English poetry, was born A.D. 1328; died A.D. 1400. The stage of our language in which his poetry is written is that known as the 'Middle English.' His chief works are, 'The Canterbury Tales,' 'The Romaunt of the Rose,' 'The Dream,' 'The Testament of Love,' &c. &c.]

A TRUE good man was there of religion,
 Pious and poor—the parson of a town.
 But rich he was in holy thought and work;
 And thereto a right learned man; a clerk
 That Christ's pure Gospel would sincerely preach,
 And his parishioners devoutly teach.
 Benign he was and wondrous diligent,
 And in adversity full patient,
 As proven oft to all who lack'd a friend.
 Loth for his titles to ban or contend,
 At every need much rather was he found
 Unto his poor parishioners around
 Of his own substance and his dues to give:
 Content on little, for himself, to live.

Wide was his cure, the houses far asunder,
 Yet never fail'd he, or for rain or thunder,
 Whenever sickness or mischance might call,
 The most remote to visit, great or small,
 And, staff in hand, on foot the storm to brave.

This noble ensample to his flock he gave,
 That first he wrought, and afterwards he taught,
 The word of life he from the the Gospel caught;

And well this comment added he thereto,
 If that gold rusteth, what should iron do?
 And if the priest be foul on whom we trust,
 What wonder if the unletter'd laymen lust?
 And shame it were in him the flock should keep,
 To see a sullied shepherd and clean sheep;
 For sure a priest the sample ought to give
 By his own cleanness, how his sheep should live.

He never set his benefice to hire,
 Leaving his flock accomber'd in the mire,
 And ran to London cogging at St. Poul's,
 To seek himself a chauntry for souls,
 Or with a brotherhood to be enroll'd;
 But dwelt at home, and guarded well his fold
 So that it should not by the wolf miscarry.
 He was a shepherd, and no mercenary.

Tho' holy in himself and virtuous,
 He still to sinful men was mild and piteous;
 Not of reproach imperious or malign;
 But in his teaching soothing and benign.
 To draw them on to heaven by reason fair
 And good example, was his daily care;
 But were there one perverse and obstinate
 Were he of lofty or of low estate,
 Him would he sharply with reproof astound.
 A better priest is nowhere to be found.

He waited not on pomp or reverence,
 Nor made himself a spiced conscience.
 The love of Christ and his apostles twelve
 He taught: but first he followed it himselfe.

SIR LANCELOTT DU LAKE.

[This ballad, extracted from Percy's 'Reliques of Old English Romance Poetry,'
 is given as an example of that ancient and popular form of composition.]

WHEN Arthur first in court began,
 And was approvèd King,
 By force of arms great victories wanne,
 And conquest home did bring.

Then into England straight he came
 With fifty good and able
 Knights, that resorted unto him,
 And were of his Round Table:

And he had jousts and tournaments,
Whereto were many prest,
Wherein some knights did far excel
And eke surmount the rest.

But one Sir Lancelot du Lake,
Who was approvèd well ;
He for his deeds and feats of arms
All others did excel.

When he had rested him a while,
In play, and game, and sport,
He said he would go prove himself
In some adventurous sort.

He armèd rode in a forest wide,
And met a damsel fair,
Who told him of adventures great,
Whereto he gave great ear.

‘Such would I find,’ quoth Lancelot ;
‘For that cause came I hither.’
‘Thou seem’st,’ quoth she, ‘a knight full good,
And I will bring thee thither.

‘Whereas a mighty knight doth dwell,
That now is of great fame :
Therefore tell me what wight thou art,
And what may be thy name ?’

‘My name is Lancelot du Lake.’
Quoth she, ‘It likes me than !
Here dwells a knight who never was
Yet matched with any man :

‘Who has in prison threescore knights
And four, that he did wound ;
Knights of King Arthur’s court they be,
And of his Table Round.’

She brought him to a river side,
And also to a tree,
Whereon a copper basin hung,
And many shields to see.

He struck so hard, the basin broke ;
And Tarquin soon he spied :
Who drove a horse before him fast,
Whereon a knight lay tied.

'Sir Knight,' then said Sir Lancelot,
'Bring me that horse-load hither,
And lay him down, and let him rest;
We'll try our force together.

'For, as I understand, thou hast,
So far as thou art able,
Done great despite and shame unto
The Knights of the Round Table.'

'If thou be of the Table Round,'
Quoth Tarquin, speedily,
'Both thee and all thy fellowship,
I utterly defy.'

'That's over much,' quoth Lancelot, 'tho'
Defend thee by and by.'
They set their spears unto their steeds,
And each at other fly.

They couched their spears (their horses ran
As though there had been thunder),
And struck them each inmidst their shields,
Wherewith they broke in sunder.

Their horses' backs brake under them,
The knights were both astound:
To avoid their horses they made haste
And light upon the ground.

They took them to their shields full fast,
Their swords they drew out than,
With mighty strokes most eagerly
Each at the other ran.

They wounded were, and bled full sore,
They both for breath did stand,
And leaning on their swords awhile,
Quoth Tarquin, 'Hold thy hand,

'And tell to me what I shall ask.'
'Say on,' quoth Lancelot.' 'Tho'
Thou art, quoth Tarquin, the best knight
That ever I did know;

And like a knight that I did hate,
So that thou be not he,
I will deliver all the rest
And eke accord with thee.'

'That is well said,' quoth Lancelot,
'But sith it must be so,
What knight is that thou hatest thus?
I pray thee to me show.'

'His name is Lancelot du Lake;
He slew my brother dear,
Him I suspect of all the rest:
I would I had him here.'

'Thy wish thou hast, but yet unknown,
I am Lancelot du Lake!
Now Knight of Arthur's Table Round,
King Hand's son of Schuwake.

And I desire thee do thy worst.'
'Ho, ho,' quoth Tarquin, 'tho,'
One of us two shall end our lives
Before that we do go.

'If thou be Lancelot du Lake,
Then welcome shalt thou be,
Therefore see thou thyself defend,
For now defy I thee.'

They buckled then together so,
Like unto wild boars *rashing*,*
And with their swords and shields they ran,
At one another *slashing*.

The ground besprinkled was with blood,
Tarquin began to yield;
For he gave back through weariness,
And low did bear his shield.

This soon Sir Lancelot espied,
He leapt upon him then,
He pull'd him down upon his knee,
And, *rushing off his helm*,

Forthwith he struck his neck in two,
And when he had so done,
From prison threescore knights and four
Deliver'd every one.

* 'Rashing' seems to be the old hunting term to express the stroke made the wild boar with his fangs. To 'rase' has apparently a meaning somewhat similar. Thus in King Richard III. act iii. sc. 2—

He dreamt
To-night the boar had *raised* off his helm.

COMPOUND PROPORTION.

- (1) If 8 men can reap 9 acres in 14 hours, how many men will reap 26 acres in 16 hours?
- (2) A traveller journeying 12 hours a day, reaches a distance of 450 miles in 10 days; how many hours per day must he travel to complete a journey of 560 miles in 14 days?
- (3) If 20 pecks of wheat serve a family of 10 persons for 30 days, how long will 20 pecks serve a family of 12 persons?
- (4) A field of corn containing 150 acres is mown by 12 men in 12 days; how many acres could 16 men mow in 8 days?
- (5) If 25 horses eat 106 bushels of corn in 86 days, in how many days will 12 horses eat 84 bushels?

THE SAHARA.

(From 'The Tropical World,' by Dr. Hartwig.)

trop'-ics, a belt round the earth extending
23° 28' on each side of the Equator
zone, a belt; the tropics are called the
Torrid Zone
o-a'-ses, patches of fertile land in a desert
trav'-ers-ed, crossed
in'-un-da-ted, overflowed
mi-ra-ge', a deceptive appearance, gene-
rally observed in the desert or at sea
per-en-ni-al, lasting
set'-an-tar-y, not wandering
no-mad'-ic, wandering

hen'-neh, a red dye with which the Arab
women stain the palms of their hands
and their nails
va'-grant, a wanderer
mi-gra'-tions, removals from place to
place
no-mad'e, one who has no settled place of
abode
un-mit'-i-ga-ted, severe, not softened
er-rat'-ic, wandering
an-tip'-a-thy, dislike

FROM the Nile to the Senegal, and from the vicinity of Agades or of Timbuctoo to the southern slopes of the Atlas, extends the desert, which above all others has been named 'the Great.'

Surpassing the neighbouring Mediterranean at least three times in extent, and partly situated within the tropical zone, partly bordering on its confines, its limits are in many places as undetermined as the depths of its hidden solitudes. For from the mountain chains which separate it in the north from the fertile coast-lands of Barbary, and intercept the winter rains, the steppes covered with sedgy pale green Alfa-grass, and dotted here and there with grey wormwood and rosemary shrubs, or dark-leaved pistacias, only gradually merge into the naked wilderness; and in the south no geographer is able as yet to draw the line between the rainless Sahara and the well-watered lands of Nigritia. No European traveller has ever followed the southern limits of the desert from east to west,

nor is its interior known, except only along a few roads, traced for many a century by the wandering caravans. From Tafflet to Timbuctoo, or from Murzuk to Bornu, the long train traverses the desert to exchange cotton goods, silk, iron, glass, pearls, and other articles of northern industry, for the ivory, gold-dust, camels, slaves, ostrich-feathers, and tanned hides of the wealthy Soudan; and annually, from the oases of the Touat, situated to the south of Algeria, a stream of pilgrims flows to the east, and, growing as it advances through the Fezzan, Augila and Siwah, at length reaches Kosseir, on the Red Sea, where it finds vessels waiting to transport it to Djedda, situated on the opposite shore, in the vicinity of Mecca the Holy.

In general the desert may be said to extend in breadth from the thirty-ninth to the seventeenth degree of northern latitude; but while in many parts it passes these bounds, in others fruitful districts penetrate far into its bosom, like large peninsulas or promontories jutting into the sea.

Until within the last few years, it was supposed to be a low plain, partly situated even below the level of the ocean; but the journeys of Barth, Overweg, and Vogel have proved it, on the contrary, to be a high table-land, rising 1000 or 2000 feet above the sea. Nor is it the uniform sand-plain which former descriptions led one to imagine; for it is frequently traversed by chains of hills, as desolate and wild as the expanse from which they emerge. But the plains also have a different character in various parts: sometimes over a vast extent of country the ground is strewn with blocks of stone or small boulders, no less fatiguing to the traveller than the loose drift sand, which, particularly in its western part (most likely in consequence of the prevailing east winds), covers the dreary waste of the Sahara. Often also the plain is rent by deep chasms, or hollowed into vast basins. In the former, particularly on the northern limits of the desert, the rain descending from the gulleys of the Atlas, sometimes forms streams, which are soon swallowed up by the thirsty sands, or dried by the burning sunbeams. In spite of this short duration, the sudden appearance of these streams is not unfrequently the cause of serious distress to the oases which border the northern limits of the desert.

For this reason, as soon as the Atlas veils itself with clouds, horsemen from the oases of the Beni Mزاب are sent at full speed into the mountains. They form a chain as they proceed, and announce by the firing of their rifles the approach of the waters. The inhabitants of the oases instantly hurry to their gardens to convey their agricultural implements to a place of safety. A rushing sound is heard; in a short time the ground is inundated; and the little village seems suddenly, as if by magic,

transported to the banks of a lake, from which the green tufts of the palm-trees emerge like islands. But this singular spectacle soon passes away like the fantastic visions of the mirage.

The deeper basins of the Sahara are frequently of great extent, and sometimes contain valuable deposits of salt. Wherever perennial springs rise from the earth, or wherever it has been possible to collect water in artificial wells, green oases, often many days' journey apart from each other, break the monotony of the desert. They might be compared with the charming islands which stud the vast solitudes of the South Sea; but they do not appear, like them, as elevations over surrounding plains of sea, but as depressions, where animals and plants find a sufficient supply of water, and a protection, not less necessary, against the terrific blasts of the desert.

A wonderful luxuriance of vegetation characterises these oases of the wilderness. Under and between the date palms, that are planted about six paces apart, grow apricot and peach trees, pomegranates and oranges, the henneh, so indispensable to oriental beauty; and even the apple tree, the pride of European orchards. The vine twines from one date palm to another, and every spot susceptible of culture bears corn, particularly dourrah or barley, and also clover and tobacco. With prudent economy, the villages are built on the borders of the oases, on the unfruitful soil, so that not a foot of ground susceptible of culture may be lost. Sedentary Berber tribes inhabit the oases, and chiefly live upon the fruits of their date trees; while the nomadic Tuaryks and Tibbos wander, with their cattle and sheep, over the desert in quest of scanty forage and thorny shrubbery. In spite of their mutual hatred, the bonds of a common interest connect the vagrant and the agricultural tribes. Condemned to perpetual migrations, the nomade is forced to confide all the property which he is unable to carry about with him to the inhabitant of the oasis; he may even possess a small piece of land, the cultivation or care of which he entrusts to the latter, who, on his part, as soon as he has saved something, buys a sheep or goat, which he gives in charge to the nomade.

An unmitigated hatred, on the contrary, exists between the various erratic tribes, as here no mediating self-interest softens the antipathies which are almost universally found to exist between neighbouring barbarians; and their robber expeditions not merely attack the richly-laden caravan, but also the oasis which may be connected by the bonds of intercourse with their hereditary enemies. The vast tracts of sterile sand, where not even the smallest plant takes root, and which might be called the 'desert of the desert,' present the greatest conceivable contrast to its green oases. With the vegetable world the

animal kingdom likewise disappears, and for days the traveller pursues his journey without meeting with a single quadruped, bird, or insect. Nowhere are the transitions of light and shade more abrupt than in the desert, for nowhere is the atmosphere more thoroughly free from all vapours. The sun pours a dazzling light on the ground, so that every object stands forth with wonderful clearness, while all that remains in the shade is sharply defined, and appears like a dark spot in the surrounding glare.

COMPOUND PROPORTION.

- (1) How many horses can plough 960 acres in 9 days, if 14 horses can plough 840 acres in 12 days?
- (2) How much land can be ploughed by 15 horses in 11 days, if 12 horses plough 760 acres in 13 days?
- (3) In what time will 20 men earn £72, if 45 men earn £160 in 30 days?
- (4) If £96 pay the expenses of 8 persons for 15 weeks 3 days, how much will 10 persons, living at the same rate, require for 15 weeks 2 days?
- (5) If 16 houses are built by 110 men in 60 days, how many men would be required to build 42 houses of the same size in 78 days?

ALFRED THE GREAT.

871—900.

(C. MacFarlane.)

ie'-gis-la-tor, a law maker

As'-ser, a learned monk of Alfred's time,
who is said to have written the life of
that monarch

mem'-oir, an account of a person's life

pro'-fi'-clen-cy, great advancement

im'-ped'-i-ment, a hindrance

ped'-ant-ry, vain display of learning

dis'-tion, use of words

laud'-a-ble, praiseworthy

cleps'-y-dra, a water-clock

Charle'-magne or Charles the Great,
King of France and first Emperor of
Germany. Died 813

ret'-ro-grade, to go backwards

mu'-ti-la-ted, cut to pieces

pro'-mul-gate, to make publicly known

ab'-so-lute, without control

pan-e-gy'-ric, a speech in praise of any
one

un-in-ter-mit'-tent, never ceasing

ALFRED was not only the first warrior, the first statesman and legislator, but he was also the first scholar in his dominions. From Asser's interesting memoirs the fact may easily be gathered that Alfred vastly exceeded even the most learned of his prelates in scholar-like accomplishments. He states that the king's noble mind thirsted for knowledge from the very cradle, and that when a mere child he had got many of the Anglo-Saxon poems by heart. It appears highly probable that Alfred diligently studied the language between his twelfth and

eighteenth year; that he had a few Latin books with him in his solitude at Athelney, and that he was (for that time) a good Latin scholar before he invited Asser to his court. But whenever or however he obtained his knowledge of that learned tongue, he certainly showed in his literary works a proficiency in Latin which was almost miraculous for a prince in Alfred's age. The style of his works in his native language proves that his acquaintance with a few good classical models was familiar, and extended to higher things than mere words and phrases.

Alfred was accustomed to say that he regretted the imperfect education of his youth, the entire want of proper teachers, and the many difficulties which then barred his progress to intellectual improvement, much more than all the hardship and sorrows and misfortunes that befell him afterwards. As one of his greatest impediments had been the difficult Latin language, he earnestly recommended from the throne, in a circular letter addressed to the bishops, that thenceforward 'all good and useful books be translated into the language which we all understand; so that all the youths of England, but more especially such as are of gentle kind and in easy circumstances, may be grounded in letters—for they cannot profit in any pursuit until they be well able to read English.' His mind was too lofty for pedantry to reach it, and too liberal and expansive to entertain the idea that learning ought to be kept in a foreign disguise and out of the reach of the people. He looked to the intellectual improvement of the people and their religious instruction as to the only solid foundation upon which a government could repose or a throne be established. It was left to a later age to advance the monstrous principle that the bulk of mankind can be governed only by the suppression or debasement of their intellectual faculties, and that governments and all the institutions of civil life are best supported by the ignorance of the greatest part of those who live under them. The doctrine of this enlightened English king of the ninth century was,—Let there be churches, abbeyes, schools, books; let the churches be served by active and conscientious priests; let the abbeyes be filled with the most learned men that can be found; let the schools be taught by able masters; and let the books be in the language which is spoken by all the people. And the theory was carried into practice to an extent which is surprising for those times. He never rebuilt a town without furnishing it with a good capacious school; he founded or restored churches and monasteries at Athelney, Shaftesbury, Winchester, and many other places, in some of which the people had almost relapsed into heathenism; he sent into various countries in search of learned and industrious teachers, and in order that there might be books for the people to read, he wrote many himself. Even as an author, no native of England

of the old Saxon period, except the Venerable Bede, can be compared to Alfred, either for the number or for the excellence of his writings. These works were in good part translations from the Latin into Anglo-Saxon. He thus translated for the instruction of his subjects:—1. 'Orosius's History,' six books; 2. 'Gregory's Pastorale;' 3. 'St. Gregory's Dialogue;' 4. 'Bede's History,' five books; 5. 'Boetius on the Consolation of Philosophy;' 6. 'The Laws of the Mercians;' 7. 'Asser's Sentences;' 8. 'The Psalms of David.' His original works—all in the same plain-spoken language of the people, were,—1. 'An Abridgment of the Laws of the Trojans, the Greeks, the Britons, the Saxons, and the Danes;' 2. 'Laws of the West Saxons;' 3. 'Institutes;' 4. 'A Book against unjust Judges;' 5. 'Sayings of the Wise;' 6. 'A Book on the Fortunes of Kings;' 7. 'Parables and Jokes;' 8. 'Acts of Magistrates;' 9. 'Collection of Chronicles;' 10. 'Manual of Meditations.'

He was an elegant poet, and wrote a great many Anglo-Saxon poems and ballads, which were sung or recited in all parts of England, but of which we believe no trace has been preserved, though we have a few verses of a still more ancient date. In his original works, the extent of his knowledge is not less astonishing than the purity of his taste: the diction is classically easy and simple, yet not deficient either in strength or in ornament. Asser tells us that his first attempt at translation was upon the Bible, a book which no man ever held in greater reverence than King Alfred. He and the king were engaged in pleasant conversation, and it so chanced that Asser quoted a passage from the Bible with which the king was much struck. Alfred requested his friend to write the passage in a collection of psalms and hymns which he had had with him at Athelney, and which he always carried in his bosom; but not a blank leaf could be found in that book. At the monk's suggestion, the king called for a clean skin of parchment, and this being folded into fours, in the shape of a little book, the passage from the Scriptures was written upon it in Latin, together with other good texts; and the king setting to work upon these passages, translated them into the Anglo-Saxon tongue. . . .

Nothing is more astonishing in the story of this marvellous man than how he could find time for these laudable literary occupations; but he was steady and persevering in all things, regular in his habits, when not kept in the field by the Danes, and a rigid economist of his time. Eight hours of each day he gave to sleep, to his meals, and exercise; eight were absorbed by the affairs of government; and eight were devoted in study and devotion. Clocks, clepsydras, and other ingenious instruments for measuring time, were then unknown in England. *Alfred was no doubt acquainted with the sun-dial which was in*

common use in Italy ; but this index is of no use in the hours of the night, and would frequently be equally unserviceable during our foggy sunless days.

He therefore marked his time by the constant burning of wax torches or candles, which were made precisely of the same weight and size, and notched in the stem at regular distances. These candles were twelve inches long ; six of them, or seventy-two inches of wax, were consumed in twenty-four hours, or fourteen hundred and forty minutes ; and thus, supposing the notches at intervals of an inch, one such notch would mark the lapse of twenty minutes, and three such notches the lapse of an hour. These time-candles were placed under the special charge of the king's mass-priests, or chaplains. But it was soon discovered that sometimes the wind, rushing in through the windows and doors, and the numerous chinks in the walls of the royal palace, caused the wax to be consumed in a rapid and irregular manner. This induced Alfred to invent that primitive utensil, the horn lanthorn, which now-a-days is never seen except in the stable-yard of some lowly country inn, and not often even there. Asser tells us that the king went skilfully and wisely to work ; and having found out that while horn could be rendered transparent like glass, he with that material, and with pieces of wood, admirably made a case for his candle, which kept it from wasting and flaring. And therefore, say we, let none ever look upon an ostler's horn lanthorn, however poor and battered it may be, and however dim the light that shines within it, without thinking of Alfred the Great.

In his youth he was much addicted to field sports, and a perfect master of hunting, and the then newly introduced art of hawking ; but in after-life he begrudged the time which these exciting amusements demanded.

No prince of his time made such strenuous efforts in favour of education and the diffusion of knowledge among his people. Charlemagne acted upon a much vaster stage ; but in this, as in several other respects, he was left far behind by our Alfred. Since the days of the Venerable Bede, the civilisation of the country had sadly retrograded : the Danes, by directing their chief fury against the churches, abbeys, and monasteries, had destroyed the most learned of the Anglo-Saxon priests and monks, had burned their little libraries, and scared literature away from its only haunts. The schools had disappeared, there being at this period no schools or libraries in the country, except such as belonged to the monastic establishments. Alfred's own account of the state in which he found the kingdom in this respect, at his accession to the throne, is most interesting ; and his feeling of his own merits in effecting a change for the better is expressed with all the modesty of

truly great mind. In the circular letter which he prefixed to his translation of S. Gregory's 'Pastorale,' he says:—'Knowledge had fallen into such total decay among the English, that there were very few on the other side of the Humber who understood the common prayers, so as to be able to tell their meaning in English, or who could have translated into that language a Latin passage, and I ween there were not many on this side of the Humber who could do it. Indeed there were so few such, that I do not even recollect one to the south of the Thames, at the time I succeeded to the crown. God Almighty be thanked, there are now some holding bishoprics who are capable of teaching.' This Saxon king, who could practise with his own hand the mechanical arts, extended his encouragement to all the humble but useful arts, and always gave a kind reception to mechanics of superior skill, of whom no inconsiderable number came into England from foreign countries. 'No man,' says Milton, 'could be more frugal of two precious things in man's life—his time and his revenue. . . . His whole annual revenue, which his first care was should be justly his own, he divided into two equal parts: the first he employed in secular uses, and subdivided those into three—the first, to pay his soldiers, household servants, and guard; the second, to pay his architects and workmen whom he had got together of several nations, for he was also an elegant builder, above the custom and conceit of Englishmen in those days; the third he had in readiness to relieve or honour strangers, according to their worth, who came from all parts to see him and live under him. The other equal part of his yearly wealth he dedicated to religious uses, those of four sorts:—the first, to relieve the poor; the second, to build and maintain monasteries; the third, to a school where he had persuaded the sons of many noblemen to study sacred knowledge and liberal arts (some say Oxford); the fourth was for the relief of foreign churches, as far as India to the shrine of St. Thomas.'

This great prince was anxious above all things that his subjects should learn how to govern themselves, and how to preserve their liberties; and in his will he declared that he left his people as free as their own thoughts. He frequently assembled his Witenagemot, or Parliament, and never passed any law, or took any important step whatsoever, without their previous sanction. Down to the last days of his life he heard all law appeals in person with the utmost patience; and, in cases of importance, he revised all the proceedings with the utmost industry. His manifold labours in the court, the camp, the field, the hall of justice, the study, must indeed have been *prodigious*. 'One cannot help being amazed,' says Burke, *that a prince who lived in such turbulent times, who com-*

manded personally in fifty-four pitched battles, who had so disordered a province to regulate, who was not only a legislator, but a judge, and who was continually superintending his armies, his navies, the traffic of his kingdom, his revenues, and the conduct of all his officers, could have bestowed so much of his time on religious exercises and speculative knowledge; but the exertion of all his faculties and virtues seemed to have given a mutual strength to all of them. Thus all historians speak of this prince, whose whole history is one panegyric; and whatever dark spots of human frailty may have adhered to such a character, they are entirely hid in the splendour of his many shining qualities and grand virtues, that throw a glory over the obscure period in which he lived.'

Our amazement at all this bodily and mental activity must be increased by the indisputable fact that all these incessant exertions were made in spite of the depressing influences of physical pain, and constant bad health. At the age of twenty-one he was visited by a tormenting malady, the inward seat and unknown nature of which baffled all the medical skill of his 'leeches.' The accesses of excruciating pain were frequent, at times almost unintermittent; and then, if by day or by night a single hour of ease was mercifully granted him, that short interval was embittered by the dread of the sure returning anguish. But the good monk Asser, who withdraws the curtain and admits us into the sick room of the great Saxon sovereign, tells us that Heaven vouchsafed him strength to bear these mortal agonies, and that they were borne with a devout fortitude. The disease never quitted him, and was no doubt the cause of his death. 'The shepherd of his people,' 'the darling of the English,' 'the wisest man in England,' the truly illustrious Alfred, expired in the month of November, on the festival of SS. Simon and Jude, in the year 900, when he was only in the fifty-first year of his age. He was buried at Winchester, in a monastery he had founded.

COMPOUND PROPORTION.

- (1) If 24 pecks of wheat serve a family of 8 persons for 45 days, how long will 32 pecks serve a family of 15 persons?
- (2) If 10 men can reap 12 acres in 15 hours, how many men will reap 32 acres in 25 hours?
- (3) A field of wheat containing 27 acres is mown by 10 men in 9 days; how many acres could 16 men mow in 15 days?
- (4) If 52 horses eat 182 bushels of corn in 54 days, in how many days will 24 horses eat 42 bushels?
- (5) A traveller journeying 11 hours a day reaches a distance of 540 miles in 18 days; how many hours per day must he travel to complete a journey of 720 miles in 22 days?

THE FLIGHT OF BIRDS.

(From 'Habits and Instincts of Animals,' by Swinson.)

lo-co-mo'-tion, the power of moving from place to place	cen'-tre of grav'-i-ty, that point in a body at which the whole weight of the body acts
in-gen'-ui-ous-ly, cleverly	ve-lo'-ci-ty, speed
ob-lique', slanting	me'-te-or, a heavenly body which quickly comes into, and passes out of, sight
hor-i-zon'-tal-ly, pointing towards the horizon	ge-ner'-a (Lat.), plural of genus; a class, a sort
con-tract'-ed, drawn together, lessened	na-ta-to'-ri-al, relating to swimming-birds
im-pulse, power of motion given to a body	fis-al-ros'-tral, relating to birds whose beaks are so wide and gaping that they appear as if cleft
im-pel', to drive forward	
mi-gra'-tions, wanderings	
an-al'-o-gy, similarity, likeness	
buoy'-ant, light	
in-cu'-ri-ous, not inquisitive	

BIRDS are the most highly gifted of all animals, in their powers of locomotion. These consist of flying, swimming, walking, running, and diving; and are performed in very different ways and degrees. Flight is to most birds of the utmost importance, and has been thus ingeniously described:— 'When a bird is on the ground, and intends to fly, he takes a leap, stretches his wings from the body, and strikes them downward with great force; by this stroke they are put into an oblique direction, partly upwards, and partly horizontally forwards. That part of the force tending upwards is destroyed by the weight of the bird, and the horizontal force serves to carry him forward. The stroke being completed, he moves up his wings, which, being contracted, and having their edges turned upward, meet with very little resistance from the air. When they are sufficiently elevated, he makes a second stroke downwards, and the impulse of the air again moves him forward. These successive strokes act as so many leaps. When the bird wants to turn either to the right or left, he strikes strongly with the opposite wing, and this impels him to the proper side. The tail acts like the rudder of a ship, except that it moves him upward or downward, instead of sideways. If the bird want to rise, he raises his tail, and if to fall, he depresses it; whilst in a horizontal position it keeps him steady.'

The modes of flight in birds are, perhaps, as numerous as the families into which they are divided; so that a few of the most conspicuous need only be mentioned. The greater part of the birds of prey (*Raptores*) soar to an amazing height, as if a certain elevation was necessary for them to discover their prey; when that is discerned, they suddenly dart down almost perpendicularly upon their victim. Buzzards, says White, sail round in circles, with wings expanded, and motionless. It is from their gliding manner that the former are still called, in

the north of England, gleads,—from the Saxon verb *ghidan*, to glide. The kestrel, on the contrary, has a peculiar manner of hanging in the air in one place, his wings all the while being briskly agitated; hence the common name of wind-hover, given to it in some parts of England. Hen harriers fly low over heaths or fields of corn, and beat the ground regularly like a pointer or setting-dog—a fact also observed by Dr. Richardson in the harriers of Arctic America, and which is in perfect unison with their analogy to the swallows. Owls move in a buoyant manner, as if lighter than the air,—an effect in some measure produced by the singular structure of their wings. There is a peculiarity belonging to ravens that must draw the attention even of the most incurious. They are often seen, when flying in company, as if amusing themselves by striking and cuffing each other on the wing, in a kind of playful skirmish; and, when they move from one place to another, frequently turn on their backs with a loud croak, and seem to be falling to the ground. This singularity has been accounted for on the supposition that they are then scratching themselves with one foot, and thus lose the centre of gravity. Woodpeckers and some other birds fly by opening and closing their wings at every stroke; and so are always rising and falling in curves. Magpies and jays are also slow flying birds, and make their way something in the same manner. Pigeons,—and particularly the sort called smiters,—have a way of clashing their wings, the one against the other, over their backs, with a loud snap: another variety, called tumblers, receive this name from a habit they have of turning themselves in the air. The speed with which pigeons fly, particularly those denominated, and sometimes used as, carriers, is well known. An instance is recorded in the 'Annual Register' for 1765, of one which travelled no less than seventy-two miles in two hours and a half. The whole of the humming birds, although they fly not to great distances at one time, yet glance through the air with the velocity of a meteor; and, probably, for the time, fly swifter than any birds in creation. From their small size, the eye cannot follow their course but for a short distance; and the motion of the wings is so rapid as to be imperceptible to the closest observer. Geese and cranes, and most wild fowl, move in figured flights, the flock being generally ranged in a triangle; but the individuals often change their position. In these, and most of the wading genera—as the sandpipers, &c.—the tertial quills are very long, and the primaries pointed; a structure which enables them to cut through the air, probably, with greater facility. Dabchicks, moor-hens, and coots, on the contrary, are feeble-flighted birds, which merely skim the surface, and fly with their legs hanging down. This originates

not only in the shortness of their wings, but in their very forward position, by which they are placed as much out of the true centre of gravity as are the legs of auks, divers, and even of the coots themselves; that is, they are placed far behind the equilibrium of the body. There is no imperfection, however, in these birds, because their uncommon aptitude in diving amply compensates for the slight development of their wings; and they so seldom venture beyond the margin of their watery haunts, that they are rarely left without instant means of escape from their enemies.

The greatest powers of long-sustained flight, however, are given to the *natatorial* and the *fissirostral* types, or the oceanic birds and the swallows, but for very different purposes. The food of the first is to be sought for at a great distance from land; their prey, which consist entirely of marine or oceanic animals, are constantly shifting their quarters; and it is therefore necessary that their pursuers should be such perfect flyers as to be continually on the wing, either following or seeking them. Added to these reasons for the superior flight necessary to aquatic birds, it will be remembered that they are exposed, on the unsheltered bosom of the ocean, to far more violent storms than are encountered by their brethren on the land; hence, were they not endowed with far more muscular strength of wing they would inevitably perish, either by being blown completely out of their native regions, or be exhausted by fatigue before they could reach a place of shelter. The genera which comprise the albatrosses and the frigate-birds stand at the head, in this respect, of the aquatic order, and show us a remarkable development of flight. The manners of the latter we never saw to more advantage than in the magnificent harbour of Rio de Janeiro. It was, indeed, an imposing sight to contemplate half a dozen of these aerial birds soaring in mid air, and then, in an instant, as if shot, falling down with a splash into the sea upon a shoal of fish. At other times, during a storm, they soar to such a height, that, notwithstanding their size, they appear but as specks in the firmament; all their powers of motion, in fact, seem to be concentrated in their wings, for the feet are so short and weak (as in nearly all of the same order) that, when upon the ground, they may be approached with ease,—for they can scarcely walk, and take a long time, comparatively, to mount on their wings. The tropic-bird flies as high as the frigate pelican; but its range is more confined to certain latitudes, and its wings are not more developed than those of an ordinary gull. All these birds occasionally in calm weather rest themselves, after the buffetings of a storm, on the sea; but they are obviously not qualified, from the smallness of their feet, to make much way by swim-

ming. The flight of the typical swallows, as well as of the goatsuckers, is, perhaps, more rapid than that of the oceanic birds; but we question, notwithstanding their migrations, whether it is so long sustained, although it is obviously accompanied by much greater muscular exertion. The flight of the albatross and the frigate-bird is accomplished with scarcely any motion of the wings; they may be said to balance themselves in the air, rather than to use the ordinary exertion attendant upon flying; neither do they make those rapid evolutions which characterise the land birds we are now speaking of. Flight, in the swallows, is confined to that period of the day when they feed; for at other times "it is a common thing to see them perched upon naked branches of trees; but the frigate-birds are always upon the wing; they, as well as the albatross, are often met with many hundred miles from any land. Furthermore, the one pursues or hunts after the flies on which it feeds; the other rather watches for the appearance of fish near the surface, while soaring in mid air, and then only pounces or drops on its prey. It is interesting to notice these variations in the habits of two families of birds, totally different from each other in general structure and habits, and yet possessing in common a superiority of flight over almost all others of their own class.

COMPOUND PROPORTION.

- (1) If £108 pay the expenses of 10 persons for 18 weeks 6 days, how much will 18 persons, living at the same rate, require for 21 weeks 4 days?
- (2) If 220 men build 30 houses in 70 days, how many men would be required to build 54 houses of the same size in 156 days?
- (3) How much land can be ploughed by 14 horses in 9 days, if 10 horses can plough 840 acres in 12 days?
- (4) How many horses can plough 789 acres in 10 days, if 16 horses can plough 911 acres in 14 days?
- (5) In what time will 40 men earn £144, if 90 men earn £320 in 60 days?

ON CONVERSATION.

(A Letter to his Children, by Sir Matthew Hale.)

col'-our, excuse
 e-quiv'-o-cate, to speak with a double
 meaning
 con-jec'-ture, to guess
 im-per'-i-ment, not relating to the matter
 in hand, rude
 mo'-ment, importance

in-con-sid'-er-ate, thoughtless
 hus'-band-ry, farming
 in-teg'-ri-ty, honesty
 com-mend, to praise
 men'-a-cing, threatening
 so-ren'-i-ty, calmness
 de-ri'-sion, mockery, laughter

[Sir Matthew Hale, more generally known as 'Judge' Hale, was an eminent lawyer during the reigns of Charles I., Cromwell, and Charles II. He was remarkable as an impartial and upright judge, in an age of great corruption. He wrote 'Contemplations, Moral and Divine,' 'Discourse touching a Providence for the Poor,' 'Judgment of the Nature of Religion,' &c. &c. Born, 1609: died, 1676.]

DEAR CHILDREN,—I thank God I came well to Farrington this day, about five o'clock; and as I have some leisure time at my inn, I cannot spend it more to my own satisfaction, and your benefit, than, by a letter, to give you some good counsel. The subject shall be concerning your speech; because much of the good or evil that befalls persons arises from the well or ill managing of their conversation. When I have leisure and opportunity, I shall give you my directions on other subjects.

Never speak anything for a truth which you know or believe to be false. Lying is a great sin against God, who gave us a tongue to speak the truth, and not falsehood. It is a great offence against humanity itself; for, where there is no regard to truth, there can be no safe society between man and man. And it is an injury to the speaker; for, besides the disgrace which it brings upon him, it occasions so much baseness of mind, that he can scarcely tell truth, or avoid lying, even when he has no colour of necessity for it; and, in time, he comes to such a pass, that as other people cannot believe he speaks truth, so he himself scarcely knows when he tells a falsehood.

As you must be careful not to lie, so you must avoid coming near it. You must not equivocate, nor speak anything positively for which you have no authority but report, or conjecture, or opinion. Let your words be few, especially when your superiors, or strangers, are present, lest you betray your own weakness, and rob yourselves of the opportunity, which you might otherwise have had, to gain knowledge, wisdom, and experience, by hearing those whom you silence by your impertinent talking.

Be not too earnest, loud, or violent in your conversation. Silence your opponent with reason, not with noise. Be careful not to interrupt another when he is speaking; hear him out, and you will understand him the better, and be able to give him the better answer.

Consider before you speak, especially when the business is of moment; weigh the sense of what you mean to utter, and the expressions you intend to use, that they may be significant, pertinent, and inoffensive. Inconsiderate persons do not think till they speak; or they speak and then think.

Some men excel in husbandry, some in gardening, some in mathematics. In conversation, learn, as near as you can, where the skill or excellence of any person lies; put him upon talking on that subject, observe what he says, keep it in your memory,

or commit it to writing. By this means you will glean the worth and knowledge of everybody you converse with; and at an easy rate, acquire what may be of use to you on many occasions.

When you are in company with light, vain, impertinent persons, let the observing of their failings make you the more cautious, both in your conversation with them, and in your general behaviour, that you may avoid their errors. If any one, whom you do not know to be a person of truth, sobriety, and weight, relates strange stories, be not too ready to believe or report them; and yet (unless he is one of your familiar acquaintance) be not too forward to contradict him. If the occasion requires you to declare your opinion, do it modestly and gently, not bluntly nor coarsely; by this means you will avoid giving offence, or being abused for too much credulity. If a man, whose integrity you do not very well know, makes you great and extraordinary professions, do not give much credit to him. Probably, you will find that he aims at something besides kindness to you, and that when he has served his turn, or been disappointed, his regard for you will grow cool.

Beware also of him who flatters you, and commends you to your face, or to one who he thinks will tell you of it; most probably he has either deceived and abused you, or means to do so. Remember the fable of the fox commending the singing of the crow, who had something in her mouth which the fox wanted. Be careful that you do not commend yourselves.

It is a sign that your reputation is small and sinking, if your own tongue must praise you; and it is fulsome and unpleasant to others to hear such commendations. Speak well of the absent whenever you have a suitable opportunity. Never speak ill of them or of anybody, unless you are sure they deserve it, and unless it is necessary for their amendment, or for the safety and benefit of others.

Avoid, in your ordinary communications, not only oaths, but all imprecations and earnest protestations.

Forbear scoffing and jesting at the condition or natural defects of any person. Such offences leave a deep impression, and they often cost a man dear.

Be very careful that you give no reproachful, menacing, or spiteful words to any person. Good words make friends; bad words make enemies. It is great prudence to gain as many friends as we honestly can, especially when it may be done at so easy a rate as a good word; and it is great folly to make an enemy by ill words, which are of no advantage to the party who uses them. When faults are committed, they may, and by a superior they must, be reprov'd: but let it be done without reproach or bitterness; otherwise it will lose its due end and

use, and, instead of reforming the offence, it will exasperate the offender, and lay the reprover justly open to reproof.

If a person be passionate, and give you ill language, rather pity him than be moved to anger. You will find that silence, or very gentle words, are the most exquisite revenge for reproaches; they will either cure the distemper in the angry man, and make him sorry for his passion, or they will be a severe reproof and punishment to him. But, at any rate, they will preserve your innocence, give you the deserved reputation of wisdom and moderation, and keep up the serenity and composure of your mind. Passion and anger make a man unfit for everything that becomes him as a man or as a Christian.

Never utter any profane speeches, nor make a jest of any Scripture expressions. When you pronounce the name of God or of Christ, or repeat any passages or words of Holy Scripture, do it with reverence and seriousness, and not lightly, for that is 'taking the name of God in vain.' If you hear of any unseemly expressions used in religious exercises, do not publish them: endeavour to forget, or if you mention them at all, let it be with pity and sorrow, not with derision or reproach.

Read these directions often; think of them seriously; and practise them diligently. You will find them useful in your conversation, which will be every day the more evident to you, as your judgment, understanding, and experience increase. I have little further to add at this time, but my wish and command that you will remember the former counsels that I have frequently given you. Begin and end the day with private prayer; read the Scriptures often and seriously; be attentive to the public worship of God. Keep yourselves in some useful employment, for idleness is the nursery of vain and sinful thoughts, which corrupt the mind, and disorder the life. Be kind and loving to one another. Honour your minister. Be not bitter nor harsh to my servants. Be respectful to all. Bear my absence patiently and cheerfully. Behave as if I were present among you, and saw you. Remember, you have a greater Father than I am, who always, and in all places, beholds you, and knows your hearts and thoughts. Study to requite my love and care for you with dutifulness, observance, and obedience; and account it an honour that you have an opportunity, by your attention, faithfulness, and industry, to pay some part of that debt which, by the laws of nature and of gratitude, you owe to me. Be frugal in my family, but let there be no want; and provide conveniently for the poor.

I pray God to fill your hearts with His grace, fear, and love, and to let you see the comfort and advantage of serving Him; and that His blessing, and presence, and direction may be with you, and over you all.—I am your ever loving father.

COMPOUND PROPORTION.

- (1) If 135 men dig a trench 120 yards long, 5 feet wide, and 6 feet deep, in 7 days of 11 hours each, and another trench is dug by one-third the number of men in 8 days of 10 hours each, how many cubic feet of earth will be removed from the latter?
- (2) If 120 men make 3 miles of sewers 20 feet deep and 10 feet wide in 415 days of 11 hours each, how many men would be required to make one the same length and width, but 4 feet deeper, in 420 days of 10 hours each?
- (3) If 5 men can mow 11 acres of wheat in 4 days of 8 hours each, how many acres will 7 men mow in 3 days of 9 hours each?
- (4) If 12 bars of iron 5 feet long, 4 inches broad, and 3 inches thick, weigh 584 lbs., how much will 18 weigh, each $7\frac{1}{4}$ feet long, 5 inches broad, and 4 inches thick?
- (5) If 35 workmen build a wall 78 feet long, 3 feet thick, and 21 feet high in 16 days of 12 hours each, in how many days of 10 hours each would 84 workmen build a wall 196 feet long, 4 feet thick, and 27 feet high?

A BRAZILIAN FOREST.

(From 'The Naturalist on the Amazons,' by H. W. Bates.)

mon-ta'-ri-a, a sort of canoe
fo'-li-age, the leaves of trees
com-punc'-tion, a pricking of the con-
science
an-ti-ci-pa'-tion, expectation
suc'-cu-lent, juicy
ma-ter'-nal, motherly
so-li'-ci-tude, care
con'-ic-al, shaped like a sugar loaf

el-lip'-tic-al, of an oval shape
tex'-ture, manner of weaving, degree of
fineness
por'-ce-lain, a fine sort of earthenware
in'-un-da-ted, overflowed
in-teg'-u-ment, a sort of skin covering
any particular part of the body
sa-li'-va, spittle

WE ran ashore in a most lonely and gloomy place on a low sandbank covered with bushes, secured the montaria to a tree, and then, after making a very sparing breakfast on fried fish and mandioca meal, rolled up our trowsers and plunged into the thick forest, which here, as everywhere else, rose like a lofty wall of foliage from the narrow strip of beach. We made straight for the heart of the land, John Jabuti leading, and breaking off at every few steps a branch of the lower trees, so that we might recognise the path on our return. The district was quite new to all my companions, and, being on a coast almost totally uninhabited by human beings for some 300 miles, to lose our way would have been to perish helplessly. I did not think at the time of the risk we ran of having our canoe stolen by passing Indians; unguarded montarias being never safe even in the ports of the villages, Indians apparently

considering them common property, and stealing them without compunction. No misgiving clouded the lightness of heart with which we trod forwards in warm anticipation of a good day's sport.

The tract of forest through which we passed was Ygapó, but the higher parts of the land formed areas which went only a very few inches under water in the flood season. It consisted of a most bewildering diversity of grand beautiful trees, draped, festooned, corded, matted and ribboned with climbing plants, woody and succulent, in endless variety. . . . After walking about half a mile we came upon a dry water-course, where we observed, first the old foot-marks of a tapir, and soon after, on the margin of a curious circular hole full of muddy water, the fresh tracks of a jaguar. This latter discovery was hardly made, when a rush was heard amidst the bushes on the top of a sloping bank on the opposite side of the dried creek. We bounded forward; it was, however, too late, for the animal had sped in a few moments far out of our reach. It was clear we had disturbed, on our approach, the jaguar, while quenching his thirst at the water hole. A few steps farther on we saw the mangled remains of an alligator. The head, fore-quarters, and bony shell were the only parts which remained; but the meat was quite fresh, and there were many footmarks of the jaguar around the carcass; so that there was no doubt that this had formed the solid part of the animal's breakfast. My companions now began to search for the alligator's nest, the presence of the reptile so far from the river being accountable for on no other ground than its maternal solicitude for its eggs. We found, in fact, the nest at the distance of a few yards from the place. It was a conical pile of dead leaves, in the middle of which twenty eggs were buried. These were of elliptical shape, considerably larger than those of a duck, and having a hard shell of the texture of porcelain, but very rough on the outside. They make a loud sound when rubbed together, and it is said that it is easy to find a mother alligator in the Ygapó forests, by rubbing together two eggs in this way, she being never far off, and attracted by the sounds.

I put half a dozen of the alligator's eggs in my game bag for specimens, and we continued on our way. . . .

We walked over moderately elevated and dry ground for about a mile, and then descended (three or four feet only) to the dry bed of another creek. This was pierced in the same way as the former water-course, with round holes full of muddy water. They occurred at intervals of a few yards, and had the appearance of having been made by the hand of man. The smallest were about two feet, the largest seven or eight feet in diameter. As we approached the most considerable of the

larger ones, I was startled at seeing a number of large serpent-like heads bobbing above the surface. They proved to be those of electric eels, and it now occurred to me that these round holes were made by these animals working constantly round and round in the moist muddy soil. Their depth (some of them were at least eight feet deep) was doubtless due also to the movements of the eels in the soft soil, and accounted for their not drying up in the fine season with the rest of the creek. Thus, whilst alligators and turtles, in this great inundated forest region, retire to the larger pools during the dry season, the electric eels make for themselves little ponds in which to pass the season of drought.

My companions now each cut a stout pole and proceeded to eject the eels in order to get at the other fishes, with which they had discovered the ponds to abound. I amused them all very much by showing how the electric shock from the eels could pass from one person to another. We joined hands in a line, whilst I touched the biggest and freshest of the animals on the head with the point of my hunting knife. We found that this experiment did not succeed more than three times with the same eel when out of the water; for, the fourth time the shock was scarcely perceptible. All the fishes found in the holes (beside the eels) belonged to one species, a small kind of Acari or Loricaria, a group whose members have a complete integument. Lino and the boy strung them together through the gills with slender sipos, and hung them on the trees to await our return later in the day. Leaving the bed of the creek we marched onwards, always towards the centre of the land, guided by the sun, which now glimmered through the thick foliage overhead. About eleven o'clock we saw a break in the forest before us, and presently emerged on the banks of a considerable sheet of water. This was one of the interior pools, of which there are so many in this district. The margins were elevated some few feet and sloped down to the water, the ground being hard and dry to the water's edge, and covered with shrubby vegetation. We passed completely round this pool, finding the crowns of the trees on its borders tenanted by curassow birds, whose presence was betrayed as usual by the peculiar note which they emit. My companions shot two of them. At the farther end of the lake lay a deep water-course, which we traced for about half a mile, and found it to communicate with another and smaller pool. The second one evidently swarmed with turtle, as we saw the snouts of many peering above the surface of the water; the same had not been seen in the larger lake, probably because we had made too much noise in hailing our discovery on approaching its banks. My friends made an arrangement on the spot for

returning to this pool after the termination of the egg harvest on Catua.

In recrossing the space between the two pools we heard the crash of monkeys in the crowns of trees overhead. The chase of these occupied us a considerable time. José fired at length at one of the laggards of the troop, and wounded him. He climbed pretty nimbly towards a denser part of the tree, and a second and third discharge failed to bring him down. The poor maimed creature then trailed his limbs to one of the topmost branches, where we descried him soon after. . . . The height from the ground to the bough on which he was perched could not have been less than 150 feet, and we could get a glimpse of him only by standing directly underneath and straining our eyes upward. We killed him at last by loading our best gun with a careful charge and resting the barrel against the tree-trunk to steady the aim. A few shots entered his chin, and he then fell heels over head screaming to the ground. Although it was I who gave the final shot, this animal did not fall to my lot in dividing the spoils at the end of the day. I regret now not having preserved the skin, as it belonged to a very large species of *Cebus*, and one which I never met with afterwards. . . .

On our fresh route we were obliged to cut our way through a long belt of bamboo underwood; and not being so careful of my steps as my companions I trod repeatedly on the flinty thorns which had fallen from the bushes, finishing by becoming completely lame, one thorn having entered deeply into the sole of my foot. I was obliged to be left behind; Lino, the Indian, remaining with me. The careful fellow cleaned my wounds with his saliva, placed pieces of isca (the felt-like substance manufactured by ants) on them to staunch the blood, and bound my feet with tough bast to serve as shoes, which he cut from the bark of a Mongúba tree. He went about his work in a very gentle way and with much skill, but was so sparing of speech that I could scarcely get answers to the questions I put to him. When he had done, I was able to limp about pretty nimbly. An Indian, when he performs a service of this kind, never thinks of a reward. I did not find so much disinterestedness in negro slaves or half-castes.

COMPOUND PROPORTION.

- (1) If 10 women make 7 dresses in 5 days, working 11 hours each daily, in what time would 8 women make 9 dresses, working 12 hours per day?
- (2) A block of granite 8 feet long, 6 feet thick, and 4 feet wide, weighs 4 tons 8 cwt., what will be the weight of a block 8 feet long, 4 feet thick, and 6 feet wide?

- (3) If 10 men earn £45 in 13 days, how many men will earn 70 guineas in 21 days?
- (4) If 40 cannon, which fire five rounds in 6 minutes, kill 560 men in 2 hours, how many cannon, which fire 7 rounds in 8 minutes, will kill 600 men in $1\frac{1}{2}$ hour?
- (5) Suppose 6 horses require as much as 18 ponies, and 10 quarters last 8 ponies for 56 days, how long may 28 horses be kept for £56 15s. when corn is 23s. per quarter?

CANUTE.

1014—1036.

(C. MacFarlane.)

per-pet'-u-ate, to make lasting
 se-ques'-ter-ed, quiet, retired
 ves'-ti-ges, footprints
 dis-a-fec'-tion, dislike, want of loyalty
 ac-cēs'-si-ble, easily come at
 o'-ral-ly, by word of mouth
 churl, a countryman
 op-por-tune', coming at a fit time
 ex'-pi-ate, to atone for
 im-pel'-led, driven forward

pal'-li-um (Lat.), a cloak
 de-vi-a'-tion, a turning aside
 tur'-bu-lent, disorderly
 ma-rand'-ing, plundering
 dis-sev'-er-ance, a separation
 a'-li-en, a stranger, a foreigner
 plen'-i-tude, fulness
 im-mu'-ta-ble, unchangeable
 ep'-i-logue, a speech at the end of a play,
 &c.

UNLIKE his father Sweyn, Canute was a thorough and an enthusiastic Christian. His father had permitted the worshippers of Odin to destroy the Christian churches, and to revive the abominations of human sacrifices, but Canute laid the pagan temples prostrate, shattered the grim idols, and forbade the inhuman rites. He built many churches, and drew good preachers and teachers into Denmark, Norway, and Sweden, by liberally granting them houses and lands. He had the glory of completing the conversion of the Scandinavian race, and of destroying a faith which was calculated to perpetuate the spirit of war and cruelty. By his exertions and encouragement the gospel was firmly established in all the cultivated districts; the old idolatry was driven to the sequestered woods and wilds in the isles of Fionia, Laaland, and Falster, where some faint vestiges of it are still to be traced in popular usages and traditions; churches, cathedrals, monasteries, and abbeys, with their several schools and out-chapels, were erected, and filled in good part with Saxon priests, who gave back to Scandinavia the spiritual benefits their forefathers had received from the Italian missionaries of Pope Gregory, and who also imparted many temporal advantages by teaching the Danes and Norwegians sundry arts which they had hitherto neglected and despised.

The tranquillity of England, which could have been secured only by wise and good government, was so perfect, that he was

enabled to absent himself from the island frequently, and for long intervals, during none of which there appears to have been the least commotion or disaffection. Under his rule the country recovered rapidly from the desolation it had suffered, and assumed that aspect of internal tranquillity and prosperity which it had enjoyed during the last years of the reign of King Alfred. Like that great sovereign, Canute was cheerful and accessible to all his subjects, whether Danes or Saxons, and took great pleasure in old songs and ballads, and in the society of poets and musicians. He most liberally patronised the scalds, minstrels, and gleemen—the musicians and poets of the time,—and wrote verses himself in the Anglo-Saxon dialect which were orally circulated among the common people, and taken up and sung by them in the streets and market-places. His popularity was hereby greatly increased. It does not appear that he possessed anything like the learning and literary industry of the great Alfred, but his acquirements must, for the time in which he lived, have been very considerable, and he must always take rank among the ‘royal authors.’ A ballad of his composition long continued to be a favourite with the English people. All of it is lost except the first verse, which has been preserved through the monkish chroniclers of the great house of Ely, who were more interested than all other men in its preservation, for it was written in praise of their establishment, to which Canute and his queen were great benefactors. The interesting royal fragment is simply this :—

Merie sungen the muneches binnen Ely
Tha Cnut Ching row there by ;
Roweth, cuithes, noer the land,
And here we thes muneches saeng.

That is literally,—

Merrily (sweetly) sung the monks within Ely
(When) that Cnute King rowed thereby ;
Row, knights, near the land,
And hear we these monks' song.

Being in verse and in rhyme, it is thought that Canute's words are reported in their original form ; or that they cannot at any rate have been much altered. The verses are said to have been suggested to the royal Dane one day as he was rowing with some of his warlike chiefs on the river Nene, near Ely Minster, by hearing the sweet and solemn music of the monastic choir floating on the air and along the tranquil water. The Ely historian says that in his day, after the lapse of a hundred and fifty years, the song was publicly sung among the people, and remembered in proverbs.

The monks say that he had a singular affection for the fen country, and for their church, which was even then a mag-

nificent structure; and that he several times took occasion to keep the 'Festival of the Purification of the Virgin Mary' with great solemnity and a boundless hospitality at Ely Abbey. They tell one story which is both picturesque and humorous.

One year, at the season of the Purification, the weather was uncommonly severe, and all the rivers, meres, and surrounding waters were frozen over. The courtiers recommended the king to put off his visit to Ely, and keep that holy festival in some other godly house, whither he might repair without the risk of being drowned under breaking ice; but such was the love the king bore to the abbot and monks of Ely, that he could not be prevailed upon to take this advice. Canute proposed going over the ice by Soham mere, which was then an immense sheet of water, declaring that if anyone would go before and show him the way, he would be the first to follow. The courtiers and soldiers hesitated, and looked at one another with some confusion. But there chanced to be standing among the crowd one Brithmer, a churl or serf, a native of the Isle of Ely, and nicknamed Budde or Pudding, from his stoutness; and this fat man stood forth and said that he would go before the king and show him the way. 'Then go on in the name of Our Lady,' said Canute, 'and I will follow; for if the ice on Soham mere can bear a man so large and fat as thou art, it will not break under the weight of a small thin man like me!' And so the churl went forward, and Canute the Great followed him, and the courtiers, one by one, and with intervals between, followed the king; and they all got safely across the mere, with no other mishap than a few slips and tumbles on the slippery ice, and Canute, even as he had proposed, kept the Festival of the Purification with the monks of Ely. And in recompense for his opportune services, the fat man Brithmer was made a freeman, and his little property was made free; 'and so,' concludes the chronicler, 'Brithmer's posterity continue in our days to be freemen, and to enjoy their possessions as free by virtue of the grant made by the king to their forefather.'

In the year 1030 our great monarch of the North made a pilgrimage to Rome, with a view, it is said, to expiate the bloodshed and crimes which paved his way to the English throne. There can be no reasonable doubt that his devotion and superstition had much to do with this long journey; but Canute may also have been impelled by other strong motives, for there was still much to learn, in government and the useful arts, at the eternal city, and it seems that a sort of royal and ecclesiastical congress had been appointed to meet there this year, to deliberate upon the means of bettering the condition of Christendom. Whatever were the mixed motives and objects of the journey, it is admitted that it was highly beneficial to the

heart and understanding of Canute, and to the peoples over whom he ruled. He is represented as starting on his journey to Rome equipped like a common pilgrim, with a wallet on his back, and a pilgrim's staff in his hand; his earls, knights, and other attendants being equipped in the like manner. The departure and the journey must have abounded in picturesque incidents. Alfred when a boy had gone the same road with his father, had crossed the same stupendous mountains by the same rugged paths, and had paused and knelt on the same sunny slopes from which the wayfarer catches the first view of the eternal city.

On recrossing the Alps, Canute did not make his way direct to England, but went into Denmark, where he stayed several months, having apparently still some troubles and difficulties to settle in that country, where his countrymen complained more than once of the partiality he showed to the English. He, however, despatched the abbot of Tavistock with a long letter of explanation, command, advice, and exhortation, addressed to 'Egelnoth the Metropolitan, to Archbishop Alfric, to the bishops and chiefs, and to all the nation of the English, both nobles and commoners, greeting.' This interesting letter, remarkable for its mildness and simplicity, appears to have been carefully treasured. It is given entire by that best of English chroniclers, William of Malmesbury, who was born about the time of the Norman conquest, and the substance of it is given by several old Danish and Norwegian chroniclers. It has been well said that it contrasts singularly with the early education of the son of the fierce and heathen Sweyn, and with the first acts of Canute's own reign. It begins with explaining the spiritual motives of his late pilgrimage, and the nature of the spiritual power of the successor of St. Peter. It then continues: 'And be it known to you all, that at the solemn festival of Easter there was held a great assemblage of illustrious persons; to wit, the Pope John, the Emperor Conrad, and the chiefs of all the nations from Mount Garganus to our own northern sea. They all received me with distinction, and honoured me with rich presents. I have received vessels of gold and silver, and cloaks and garments of great price. I discoursed with the lord pope, the lord emperor, and other princes, on the grievances of my people, English as well as Danes. I endeavoured to obtain for my people justice and security in their journeys to Rome; and above all, that they might not henceforward be delayed on the road by the shutting up of the mountain-passes, the erecting of barriers, and the exaction of heavy tolls. My demands were granted both by the emperor and King Rudolph, who are masters of most of the passes; and it was enacted that all my people, as well merchants as pilgrims, should go to

Rome and return in full security, without being detained at the barriers, or forced to pay unlawful tolls. I also complained to the lord pope that such enormous sums had been extorted up to this day from my archbishops, when, according to custom, they went to the Apostolic See to obtain the pallium; and a decree was forthwith made that this grievance likewise should cease. Wherefore I return sincere thanks to God that I have successfully done all that I intended to do, and have fully satisfied all my wishes. And now, therefore, be it known to you all, that I have dedicated my life to God, to govern my kingdoms with justice, and to observe the right in all things. If in the time that is past, and in the violence and carelessness of youth, I have violated justice, it is my intention, by the help of God, to make full compensation. Therefore I beg and command those unto whom I have intrusted the government, as they wish to preserve my good will, and save their own souls, to do no injustice either to poor or rich. Let those who are noble, and those who are not, equally obtain their rights, according to the laws, from which no deviation shall be allowed, either from fear of me, or through favour to the powerful, or for the purpose of supplying my treasury. I want no money raised by injustice.

It is said that after the visit to Rome, Canute was milder and juster than he had been before, and that inasmuch as he was concerned he acted up to the spirit of his famous letter. He reigned four or five years longer, and these appear to have been years of tranquillity and happiness for England. No power from beyond sea could touch our coast, or dispute the sovereignty of the ocean with his fleets; and the turbulent and marauding Scots, Cumbrians, and Welsh, were chastised and kept in awe by his English militia. Malcolm, the Scottish king, is said to have become his liegeman, or to have acknowledged his supremacy. The 'Basileus,' or emperor of the Anglo-Saxons—for this was the title which Canute took to himself in the latter part of his reign—could thus boast that the English, the Scotch, the Welsh, the Danes, the Swedes, and the Norwegians were his subjects; and he was called the 'King of Six Nations.' Throughout Europe he was looked upon as the greatest of modern sovereigns. Conrad the emperor, who claimed to be the representative of the imperial Cæsars, and supreme head of the christianised and holy Roman empire, might make a show of prouder titles, but in extent of real dominion, in wealth and power, Conrad was as nothing compared with Canute, the descendant of the pirates of Denmark. The ability, the energy, the industry, which could keep such vast and distant countries together, and bring so many barbarous, warlike, and cruel people within the pale of Christendom, must

have been altogether extraordinary. The dis-severance which immediately followed his death is a proof that the union depended on the personal character and genius for government of Canute the Great. In England he had the rare art and happiness to make a conquered people forget that they had been conquered, and that he was a conqueror and an alien. When the first cruel excesses were over, and when his throne was established in peace, the Anglo-Saxons appeared to have ceased to consider him as a foreigner. The chroniclers scarcely ever allude to his foreign birth; with them he is 'Rex Noster—our King, just and good; our pious king,' &c. No doubt his accomplishments as a poet in the Anglo-Saxon language aided in bringing about this advantageous and rare result, which must have been further promoted by his reverence for the old Anglo-Saxon laws, by his zeal for the Christian religion, and by his exceeding liberality to the Anglo-Saxon Church.

It was after his return from Rome, and when he was in the plenitude of his power, that the following universally known incident is related of him and his flattering courtiers. One day, disgusted with their extravagant adulations, he determined to read these courtiers a practical lesson. He caused his golden throne to be placed on the verge of the sands on the sea-shore as the tide was rolling in with its resistless might, and putting his jewelled crown upon his head, and seating himself upon the throne, he thus addressed the ocean and said:—'Ocean! the land on which I sit is mine, and thou art a part of my dominion; therefore rise not, but obey my commands, nor presume to wet the edge of my royal robe.' He sat for some time silent, with his eye fixed on the broad water as if expecting obedience; but the sea rolled on in its immutable course, succeeding waves broke nearer and nearer to his feet, the spray flew in his face, and at length the skirts of his garment were wetted, and his legs were bathed by the waves. Then, rising and turning to his flatterers, Canute said:—'Confess now how frivolous and vain is the might of an earthly king compared to that Great Power who rules the elements, and says unto the ocean, "Thus far shalt thou go and no farther!"' The monks conclude the epilogue by saying that he forthwith took off his crown, and, depositing it in the Cathedral of Winchester, never wore it again.

COMPOUND PROPORTION.

- (1) If 20 men can mow 42 acres of wheat in 3 days of 10 hours each, how many acres will 18 men mow in 4 days of 7 hours each?
- (2) If 24 workmen build a wall 98 feet long, 2 feet thick, and 33 feet high, in 21 days of 11 hours each, in how many days of

- 9 hours each would 49 workmen build a wall 168 feet long, 3 feet thick, and 28 feet high?
- (3) If 10 bars of iron, 9 feet long, 5 inches broad, and $4\frac{1}{2}$ inches thick, weigh 432 lbs., how much will 16 weigh, each 12 feet long, 6 inches broad, and 4 inches thick?
- (4) If 144 men make 5 miles of sewers, 15 feet deep and 13 feet wide, in 396 days of 10 hours each, how many men would be required to make one the same length and width, but 5 feet deeper, in 528 days of 9 hours each?
- (5) If 441 men dig a trench 400 yards long, 6 feet wide, and 4 feet deep, in 8 days of 9 hours each; and another trench is dug by $\frac{1}{3}$ rd the number of men in 6 days of 13 hours each, how many cubic feet of earth will be removed from this latter?

HEAT : RADIATION AND CONDUCTION.

(From the 'Saturday Magazine'.)

func'-tion, *duty, office*
 de-fi'-cien-cy, *want*
 phra-se-ol'-o-gy, *mode of speech*
 en-er-get'-ic, *forcible*
 ab-strac'-tion, *the act of drawing away*
 per'-ma-nent-ly, *lastingly*
 tem'-po-ra-ri-ly, *not permanently*
 es-sen'-tial, *necessary*
 hor-i-zon'-tal-ly, *in a level or horizontal*
 direction
 ob-lique'-ly, *in a slanting direction*

a-ir'-ri-form, *in the form of air or*
 vapour
 fa-cil'-i-ty, *easiness*
 plat'-in-um, *a whitish metal, the heaviest*
 known, and the most difficult to melt
 ac-cel'-e-ra-ted, *hastened*
 cu'-li-na-ry, *relating to cookery*
 dis-sim'-i-lar, *unlike*
 dis-se'-pa-ted, *scattered*
 vi-cin'-i-ty, *neighbourhood*

WHATEVER may be the nature of heat, be it a peculiar *substance*, or a peculiar *property*, we know that it exists. To its influence we are indebted for the due performance of all the functions of life, for all that cheers the eye, delights the ear, and gratifies the taste. Nor is it to heat only, but to its being supplied to us in due proportions, that we owe so much. Its excess, or its deficiency, would be equally fatal to vegetable and animal existence. In one case the earth would become a parched desert, in the other an ice-bound plain.

It is important that we should distinguish between heat itself, and the sensation of heat. The first is a cause, the second is its effect. With a view to prevent mistakes, by the frequent interchange of terms, meaning sometimes one thing, and at other times another, the term *caloric* is now employed by scientific writers to denote that condition of bodies by which the sensation of heat is produced; or, in other words, to define the cause of heat as distinct from its effects. Wishing to refrain as far as possible from scientific phraseology, we shall restrict ourselves to the ordinary term (*heat*), requesting our readers to remember that, unless the contrary is distinctly stated, it always

means heat, as an element residing in, or operating upon, matter, without any regard to our feelings.

By the continual use of the terms *heat* and *cold*, in the affairs of common life, we sometimes employ the latter term, as if it was descriptive of an element, or an agent, equally energetic in itself as any other with which we are acquainted, but whose properties are directly the opposite of those possessed by heat. Cold is only the absence of heat. It is easier, and, because we are accustomed to it, more natural to say, 'It is cold,' than it is to describe that condition by saying, 'There is a deficiency of heat.' The latter, however, is a correct definition. We know by experience that the gradual abstraction of heat from a body, which at first may possess so much of it as to be unapproachable, induces the sensation we denominate cold. But cold is only a relative term. We know nothing of matter where heat is not present. There is less heat in one substance than in another, but of absolute cold we have no conception.

Temperature is a term that will very often occur whilst treating of the properties of heat. We think it right at once to explain its signification. The temperature of a body means its *sensible heat*, that is, the heat of which some estimate may be formed by the thermometer. In comparing two different substances, or two distinct parts of the same substance, if we find the first communicates to the thermometer more heat than the second, we say the temperature of the former is *higher* than that of the latter; or, that the temperature of the latter is *lower* than that of the former. Higher and lower, as applied to temperature, are terms that evidently owe their origin to the operation of the thermometer; since the smaller the quantity of sensible heat present in any substance with which the bulb of a thermometer is placed in contact, the lower will the column of mercury or other fluid within the tube descend; the greater the quantity of sensible heat, the higher will it rise. The sensible, or, as it is commonly termed, *free*, heat thus discoverable in any particular substance by the aid of a thermometer, must be viewed as entirely independent of the heat which permanently resides in that substance, or which may be temporarily combined with it in a *latent*, that is, a concealed state. We may satisfy ourselves that a vast quantity of heat has entered into some particular substance, but we can neither detect the presence nor estimate the quantity of that which is latent by our ordinary perceptions, nor through the agency of a thermometer.

Heat is communicable from one substance to another by *radiation* and *conduction*. Radiation takes place between bodies whose temperatures are unequal, at sensible distances. Contact is a condition essential to conduction.

If a piece of heated metal be placed in the centre of a room, midway between the ceiling and the floor, heat will be disengaged from it equally in all directions, upwards, downwards, horizontally, and obliquely ; which may be proved by the melting of a small quantity of tallow placed at certain distances around the metal. This is an instance of radiation. When the bowl of a metal spoon is left, for a few minutes, in a cup of hot tea, the handle of the spoon acquires the same temperature as that of the tea. Here we have an instance of conduction. In one case, the heat separated from the metal will affect the tallow at some distance, passing readily through, or among, the particles of the intervening air. In the other case, the heat first communicating with that part of the spoon in contact with the tea, it is, if we may employ the expression, pushed forward from particle to particle of the metal, along the handle, until it reaches its extremity.

As radiation and conduction commonly operate together, they may be considered as different parts, or rather, different forms, of the same process—both equally dependent on that property peculiar to heat, by which it tends to diffuse itself in every direction, and among the particles of every species of matter, whatever may be its form, size, colour, or quality. Thus, if any number of vessels, some constructed of metal, others of wood, others of stone, and others of glass, each vessel containing a liquid of a different kind and at a different temperature, be placed in the same room, the liquids and the vessels containing them will, in a few hours, all arrive at the same temperature, which will be that of the air in the room. The same would, of course, be the result, with solid or with æriform bodies, as with liquids.

Radiation and conduction may be further explained by considering the former as operating at the surfaces of bodies, whilst the latter goes on throughout their interior parts. The rate at which heat is radiated and conducted by any substance, depends very much on the nature of the materials of which that substance is composed. Radiation is also influenced in a remarkable degree by the colours and other conditions of the surfaces of bodies.

Those bodies into which heat enters with facility, and among whose particles it is transmitted rapidly, are called *good conductors*. Those, on the contrary, which offer considerable resistance to the progress of heat among their particles, are termed *bad conductors*. The latter are frequently denominated *non-conductors*, a description not philosophically correct ; since every substance with which we are acquainted will conduct heat, although in some its transmission is exceedingly slow.

Among *good conductors* the metals are the best ; of the

gold, silver, platinum and copper are nearly equal. The next in order are iron and zinc, then tin, and the slowest conductor of them all is lead. Wood, stone, and bricks are among the bad conductors: of this class the most perfect are wool, hair, cotton, the fur of animals, the feathers of birds, and especially the down of the swan. Liquids and æriform bodies, when there is no motion among their particles, are bad conductors of heat. If freedom of motion be established, they become good conductors. The rate at which heat is radiated is dependent, in a remarkable degree, on the colour and other conditions of the surfaces of bodies.

If any quantity, say, for instance, a pint, of boiling water be poured into a polished metal tea-pot, and an equal quantity of water, at the same temperature, into a rough black earthenware tea-pot, both the vessels standing in the same room, and at no great distance from each other, the water in the earthenware pot will cool down to the temperature of the surrounding air in less time than that in the metal pot. For a polished metal pot, if we substitute one whose exterior has become rough and tarnished by neglect or ill usage, the water will be found to cool quicker in that than in the other. In addition to the last-mentioned metal pot being rough and discoloured, if it be painted black or some dark colour, the rate of cooling of the contained water will thereby be still further accelerated; but it will be less rapid than in the earthenware pot.

Hence we may learn, that a metallic tea-pot is the most useful, as respects keeping the tea hot, but to insure all its advantages it should be kept clean and well polished. The same will apply to tea kettles and various other culinary vessels. Those which are kept clean and bright will retain the heat of water, or other liquids contained in them, much longer than those whose exterior surfaces are rough and discoloured.

The circumstances that assist in determining the rate at which heat is disengaged *from* the surfaces of bodies operate equally favourably upon that which is directed *towards* those surfaces. Any substance that radiates heat rapidly, will absorb it in the same proportion, provided that in each case the conditions are alike favourable. Those substances, whose surfaces are smooth and bright, and of a light colour, reflect heat; that is, they turn it aside from its straight course, and thus interrupt its progress. Those substances, whose surfaces are rough and dark-coloured, radiate and absorb heat. Hence that substance which reflects heat the most perfectly, is the very worst that can be selected for its radiation or absorption. Water or any other liquid may be made to boil in less time, all other circumstances being the same, in a rough and discoloured metallic vessel, than in one whose outside is perfectly clean *and bright*. If the metallic and earthenware tea-pots already

mentioned, be both filled with cold water, say at the temperature of 45° , and placed in a room whose temperature is 70° , the water in the earthenware pot will acquire the temperature of the air in the room in less time than that in the polished metal pot; proving that the same conditions influence the absorption of heat that, in the first-cited experiments, would be seen to determine its radiation.

In the houses of the wealthy, stoves are sometimes employed which are made of polished metal. This is the most injudicious arrangement that could possibly be devised for heating the apartments in which such stoves are fixed. On the same principle, it is improper to surround a fireplace with porcelain tiles; or, if we wish our feet to receive any benefit from a fire, to place in front of it a polished fender. Rough and dark-coloured surfaces are best adapted for domestic stoves. Such stoves are not only the most useful, but the most economical, since, in diffusing heat into the apartment by radiation, the benefits of the ignited fuel in the grate are materially increased. Blacklead, with which stoves are usually polished, could be very well dispensed with, were it not, that in this instance, as in many others, we cheerfully surrender a little scientific propriety rather than part with our early associations and habits of cleanliness.

Nothing is more difficult than to form an accurate estimate of the temperature of different substances by means of our ordinary perceptions. If we would avoid frequent mistakes on the subject, we must constantly submit our sensations to the correction of our judgment.

Heat and cold, as ordinarily experienced by us, depend on the previous temperature of the particular parts of the body in which these sensations may be induced; and the temperature and rate of conduction possessed by the substance with which such parts may be in contact.

On a cold day in winter, if we descend into an underground cellar, or arched vault, the included air will communicate a sensation of warmth. On a warm day in summer, air at the same temperature, in the same cellar or vault, will produce the opposite sensation of cold. In winter the external air being at a lower temperature than that in the vault, we pass from a cold to a warm medium. In summer the air in the vault will be at a lower temperature than that of the external air, and we consequently pass from a cold to a warm medium. Notwithstanding the apparent contradictions in our sensations, it rarely happens that the temperature of the air in a cellar or vault is so high in winter as it is in summer. If we were to judge only by its effects on our body, we should pronounce a different decision.

On examining dissimilar substances in the same room, with a view to ascertain their temperatures, if we have no better guide than our sensations, we shall arrive at very incorrect conclusions. Placing the hand successively in contact with a carpet, a table, a marble slab, a polished brass or iron fender, we shall, in the absence of any other information than that derived from our feelings, pronounce the table to be colder than the carpet, the marble slab to be colder than the table, and the fender to be colder than the marble. A thermometer will inform us that the several articles we have enumerated are all at an equal temperature. The different sensations produced by them are, therefore, entirely due to the difference in their rates of conducting heat.

Wool is denominated a bad conductor. The heat in the hand placed in contact with a carpet, will pass through, or among, the fibres of the wool, but very slowly. Wood is a bad conductor, but it conducts more rapidly than wool. Compared with the carpet the table will feel cold, because in a given time a greater quantity of heat will pass from the hand to the table than from the hand to the carpet. Marble is classed among bad or imperfect conductors of heat, but it possesses this property in a more eminent degree than either of the before-mentioned substances. Metals are good conductors. The fender, therefore, will feel colder than the other articles, because, in a given time, it will abstract or carry away from the hand a greater quantity of heat than either the carpet, the table, or the marble slab.

A substance whose surface is smooth or polished, will excite the sensation of cold in a more intense degree than another substance, or a different part of the same substance, at the same temperature, whose surface is rough and irregular. This effect is chiefly mechanical, and it is occasioned by the more perfect contact that takes place between the hand and a smooth surface, than one which is rough and irregular.

We may place the hand in contact with a bad conductor of heat without experiencing pain, whilst similar contact with a good conductor, at the same temperature, will inflict a severe wound. In the first instance the heat, moving slowly towards the hand, is easily dissipated; in the second, its motion being rapid, it accumulates, and destroys the parts in its immediate vicinity. For these reasons we perceive the propriety of adapting handles of wood to tea and coffee-pots, box-irons, and many other utensils that are employed at a high temperature. So also, folds of woollen cloth or leather are interposed between the hand and a heated metallic body, for the purpose of intercepting the heat. By constant exposure to the effects of a high temperature, the skin on the inside of the hands will become so

thick and insensible as to resist a degree of heat that would scorch to the bone an unpractised hand. Instances are recorded of workmen employed in the smelting of copper, who could dip their hands into the liquid metal without experiencing pain. We knew a female servant who was in the habit of taking vegetables and other articles of food from a saucepan or pot of boiling water, with her hands, instead of using a fork or a ladle.

Those persons who are exposed to a high temperature in their ordinary avocations, generally take the precaution to wear woollen clothing. Others, who voluntarily expose themselves to extraordinary degrees of heat, for the purpose of exciting wonder, or gaining a subsistence, are not endowed with any peculiar properties by which they resist its effects. Their secret consists in availing themselves of bad-conducting substances, covering their bodies with woollen garments, shielding their feet by wooden clogs, and carefully avoiding contact with metals, or other conductors of heat. It is possible to remain a short time in a room, constructed for the purpose, whose temperature is sufficiently high to broil a steak. This has been done without any very great inconvenience, by men whose testimony may be implicitly relied on.

GREATEST COMMON MEASURE AND LEAST COMMON MULTIPLE.

Find the G. C. M.

- | | |
|------------------------|----------------------|
| (1) 700 and 2030. | (2) 504 and 1232. |
| (3) 780 and 4095. | (4) 6363 and 7878. |
| (5) 42600 and 666456. | (6) 13632 and 22464. |
| (7) 12096 and 13824. | (8) 11236 and 644. |
| (9) 2432187 and 26244. | |

Find the L. C. M.

- | | |
|----------------------------|---------------------------|
| (1) 10, 25, 40, 24. | (2) 6, 18, 27, 34. |
| (3) 12, 28, 30, 90, 184. | (4) 32, 96, 160, 192. |
| (5) 162, 81, 213, 54, 324. | (6) 32, 84, 126, 28, 144. |

Reduce to lowest terms.

- (1) $\frac{81}{180}$. (2) $\frac{782}{2876}$. (3) $\frac{2904}{4358}$. (4) $\frac{1278}{1662}$. (5) $\frac{1944}{1888}$. (6) $\frac{1952}{1184}$. (7) $\frac{19280}{14476}$.

Reduce to their least common denominators.

- (1) $\frac{3}{4}$, $\frac{9}{16}$, $\frac{7}{12}$. (2) $\frac{5}{8}$, $\frac{9}{16}$, $\frac{11}{24}$. (3) $\frac{7}{18}$, $\frac{11}{12}$, $\frac{14}{36}$, $\frac{11}{20}$. (4) $\frac{7}{18}$, $\frac{5}{8}$, $\frac{17}{26}$, $\frac{7}{20}$.

NO AGE CONTENT; THAT OF CHILDHOOD
THE HAPPIEST.*(Earl of Surrey.)*

Born, 1516; beheaded, 1547. Poems of a miscellaneous character.

LAYD in my quiet bed,
In study as I were,
I saw within my troubled head,
A heap of thoughts appear.

And every thought did show
So lively in mine eyes,
That now I sighed, and then I smiled,
As cause of thoughts did rise.

I saw the little boy,
In thought how oft that he
Did wish of God, to 'scape the rod,
A tall young man to be.

The young man eke that feels
His bones with pain opprest,
How he would be a rich old man,
To live and lie at rest.

The rich old man that sees
His end draw on so sore,
How he would be a boy again,
To live so much the more.

Whereat full oft I smiled,
To see how all these three,
From boy to man, from man to boy,
Would chop and change degree.

And musing thus, I think,
The case is very strange,
That man from wealth, to live in woe,
Doth ever seek to change.

Thus thoughtful as I lay,
I saw my withered skin,
How it doth show my dented thews,
The flesh was worn so thin;

And eke my toothless chaps,
The gates of my right way
That opes and shuts as I do speak,
Do thus unto me say :

The white and hoarish hairs,
The messengers of age,
That show, like lines of true belief,
That this life doth assuage ;

Bids thee lay hand, and feel
Them hanging on my chin.
The which do write, two ages past,
The third now coming in.

Hang up, therefore, the bit
Of thy young wanton time,
And thou that therein beaten art,
The happiest life define.

Whereat I sighed, and said,
Farewell my wonted joy,
Truss up thy pack, and trudge from me,
To every little boy ;

And tell them thus from me,
Their time most happy is,
If to their time they reason had,
To know the truth of this.

THE MEANS TO ATTAIN A HAPPY LIFE.

(Earl of Surrey.)

MARTIAL, the things that do attain
The happy life, be these, I find,
The riches left, not got with pain ;
The fruitful ground, the quiet mind ;

The equal friend ; no grudge, no strife ;
No charge of rule, nor governance ;
Without disease, the healthful life ;
The household of continuance :

The mean diet, no delicate fare ;
True wisdom joined with simpleness ;
The night discharged of all care ;
Where wine the wit may not oppress.

The faithful wife—without debate;
Such sleeps as may beguile the night;
Contented with thine own estate,
Ne * wish for death, ne† fear his might.

VULGAR FRACTIONS.

Reduce to improper fractions.

- | | | | |
|-----------------------------|------------------------------|---------------------------|---------------------------|
| (1) $9\frac{1}{2}$ | (2) $6\frac{3}{8}$ | (3) $7\frac{9}{10}$ | (4) $11\frac{2}{5}$ |
| (5) $4\frac{5}{8}$ | (6) $21\frac{7}{8}$ | (7) $36\frac{11}{16}$ | (8) $94\frac{21}{32}$ |
| (9) $63\frac{19}{37}$ | (10) $71\frac{31}{48}$ | (11) $126\frac{1}{4}$ | (12) $126\frac{27}{32}$ |
| (13) $465\frac{213}{408}$ | (14) $1015\frac{315}{768}$ | (15) $1246\frac{59}{384}$ | (16) $2346\frac{78}{497}$ |
| (17) $8096\frac{349}{1012}$ | (18) $19668\frac{109}{1088}$ | | |

Reduce to whole or mixed numbers.

- | | | |
|--|--|--|
| (1) $\frac{8}{9}, \frac{9}{4}, \frac{8}{8}$ | (2) $\frac{18}{8}, \frac{27}{3}, \frac{36}{18}$ | (3) $\frac{31}{8}, \frac{45}{11}, \frac{56}{5}$ |
| (4) $\frac{19}{10}, \frac{98}{37}, \frac{98}{18}$ | (5) $\frac{118}{18}, \frac{136}{28}, \frac{148}{18}$ | (6) $\frac{198}{38}, \frac{246}{112}, \frac{459}{124}$ |
| (7) $\frac{528}{346}, \frac{789}{19}, \frac{1012}{21}$ | (8) $\frac{1368}{1001}, \frac{6648}{784}, \frac{10128}{968}$ | |

PERSIAN PREJUDICES.

'From 'All the Year Round,' July 1868.)

dex-ter'-i-ty, skill
em'-bas-sy, a public message and those
who carry it
ra-pa'-ci-ty, the act of seizing by force,
extortion
khan, a Persian governor
suc'-cu-lent, juicy
Nes-to'-ri-ans, a sect of Christians re-
siding in Persia and the Levant, who
consider Mary as the mother of Jesus,
but not the mother of God
rec'-on-cile, to make to agree

in-tol'-er-ance, not allowing others to
have opinions of their own
fan-at'-i-clism, wildness of conduct in
respect to opinions
as-trol'-o-ger, one who pretends to pro-
phesy by studying the stars
lon-gev'-i-ty, length of life
O-ri-ent'-al, Eastern
ir'-ri-gate, to water crops
fa-cil'-i-tate, to make easy
de-cliv'-i-ties, slopes
sub-ter-ra'-ne-an, underground

No rank or position in life is beyond the reach of the stick in Persia, and the people really seem only to admire and respect those who have the power and the will to use it. I have seen a Persian minister whose toe-nails had been beaten off by the Shah, and whose feet were so lacerated that they festered, and he was obliged to keep his bed for six months in consequence; but he seemed to feel no anger, irritation, or shame upon the subject, but spoke of it without hesitation or reserve. 'He is a very great king, the Shah! a very great king indeed!' he would say; 'look at my feet.'

When Lady MacNiell visited the royal harem by invitation, a number of young princes were at play in the apartments of their mothers, blindfolded. Lady MacNiell enquired why the

* Neither.

† Nor.

children were thus blindfolded, and their mothers composedly replied that they were merely practising to acquire dexterity, that in case their eyes should be put out when they became men, they might be able to walk about, and be less dependent in consequence of this early training.

The King of Persia is called 'King of Kings,' and 'The Centre of the World.' He often concludes an official document with the information that if the receiver does not obey the commands contained in it, he shall have a kick from which he will not recover in this world.

A kind and merciful man was, not long ago, appointed governor of a province through the influence of one of the European embassies, and he had got, somehow, many new-fangled ideas into his head. Among other things, he desired to govern with justice and moderation, as far as the rapacity of the court would allow him; and for some time, he could not understand how it was that he was so universally unpopular. There was no overlooking the fact that the people not only disliked, but they despised him. In his perplexity, he asked counsel of one of the oldest inhabitants of the city which was the seat of his government. The venerable sage, who had been brought to his prescience with some difficulty, eyed him slyly. 'We are,' said he, 'accustomed to be beaten, and you do not beat us: we, therefore, naturally suppose that you cannot and dare not do so, and we consider it as an affront that a person of so little consequence has been appointed to rule over us.' 'If this is the case,' returned the governor, reconverted at once to the faith and customs of his country by an argument so unanswerable, 'you shall be satisfied to your heart's content; and, to mark my respect for your person, I will have you beaten first.' The old man made no objection, and, some time after, hobbled away with sore feet to tell his admirers that the governor was not really such a contemptible person as he seemed. This opinion was confirmed on the following day, when all the chief merchants were seized and flogged, after which the governor got on very well with them, till, in due time, he was, of course, replaced by one who had no European prejudices at all. These stories would have no salt in them if they were not true, but, indeed, the stick is the principal element in the life of a Persian. There was a khan with whom I was in the habit of dining while in Persia, and one day it must be confessed that the pilaff was less succulent than could have been wished. I innocently confided my sentiments upon the subject to my entertainer, and, shortly afterwards we heard some shrill cries. 'It is,' said my host politely, in answer to my enquiring glance, 'the cook; we shall have a better pilaff next time.' And, in truth, when I dined with the khan again, the pilaff was

quite a gastronomic triumph. The stick and its uses are so well known in Persia, that it is considered the extreme of ill manners to enter a house with a cane in one's hand.

In the Persian method of bastinadoing, the ankles of the culprit are bound to a pole from ten to fifteen feet long; he is then thrown down on his back upon the pavement, and the pole is raised and supported by men at the two ends. The culprit thus lies entirely helpless, however much he may struggle, and his legs, extending upwards, the bottoms of his feet present a fine flat surface to the application of the rod. An officer brings forward a large bundle of rods, perhaps a hundred in number, six or eight feet long, from the storehouse of the magistrate, in which they are always kept ready; three or four other officers take each a rod, and thump away till it is worn out, and then renew it from the bundle.

The late prime minister received three thousand blows with sticks on the soles of his feet for striking one of the king's servants. He was then minister for war. He was laid up for a long time, and lost all his toe-nails.

Of course the effects of torture in obtaining confessions from accused people are such as may be imagined. 'How much did you steal?' enquired a judge of one quivering state criminal. The man shrieked out in his agony that he had stolen one hundred thousand tomauns. The sum missed, however, was only twenty-one thousand, and he was tortured again till he named that sum. . . . Of course such a state of things as this could only exist together with extreme ignorance, and truly the ignorance of the Persians can hardly be surpassed, though they have indeed great natural wit.

Some innocent American missionaries, who founded a school among the Nestorians, were much delighted by the cheerfulness and regularity with which three scholars, the sons of a widow, attended at their seminary, and the comfort and benefit they were glad to declare that they derived upon all occasions from the instruction provided for them. This agreeable state of affairs lasted about three weeks, when, the old lady, their mother, sent in a bill for their attendance; and upon the astonished missionaries making some objections to pay a demand so unexpected, she at once removed them from the school, saying, that 'they were not slaves to work all day for nothing, and that the politeness which they had hitherto shown in reading the missionaries' books for them had its limits, and was now exhausted.' The ignorance of the Persians is not less than their intolerance and fanaticism.

A Persian nobleman, who was very sick, was induced by the example of the court to consult a Frank doctor, but he begged that a Persian might be allowed to prepare the medicine which

he was to take, for he could not consent to swallow anything which had been made up by Christian hands.

The Persians wash their hands after touching a Christian even by accident, and say a short prayer. They will not allow a Christian to go even to their public baths. They wash a cup three times after he has drank from it. They will not again sit upon the same carpet that he has pressed. But they have learned to know that some of the Franks are angry men; they have seen their most terrible chiefs go down before the Frankish swords like corn before the sickle. They have seen their clouds of innumerable horsemen scattered like dust by the mighty array of Christian armies. They are also a polite and courteous people—the Frenchmen of the East. They are therefore at much pains to reconcile fanaticism, and a fear of the consequences of its exhibition. A Frankish stranger, on entering a Persian house, will probably notice that there is a smart carpet laid down apart in a particular corner of the room for him; that upon the tea-tray there is one particular cup, prettier than the rest, which is offered to him; and that the sherbet is served to him in a glass differing from the others, and probably more costly. All these are devices to conceal the utter loathing with which he is regarded by his host. Their intolerance and superstition are about on a par, as may be supposed. Though they pretend to despise the Christian faith, they like to have a Bible in the room for a sick person. They suppose that it prevents the entrance of evil spirits. A sick person is, moreover, never left alone, for fear of demons. . . . The Persians attribute the frequent earthquakes in their country to the fact that the earth stands upon a great bull, which, being now and then stung by a fly, shakes his head, and thus causes a shock to his burden.

The custom of trying a fall—that is to say, of opening the Koran where it will, and taking the first passage that meets the eye for counsel in time of difficulty—is a common practice. They place such implicit faith in it, that they will not take medicine during sickness if the fall is unfortunate. They observe happy hours, and consult astrologers respecting them. Even the king has an astrologer, and the priesthood do not reprove the custom of taking advice from him. Superstitions often become grave matters of state, upon which important affairs may depend. I remember a French ambassador having been conducted in state to the capital, during an awful snow-storm, because it had been declared by the astrologers to be his 'happy hour.' It is the fashion, and a very old one, to keep a pig in the stable of valuable horses, that the evil eye may fall upon him, or demons may play their pranks with him rather than the horses. When a great man is travelling, a sheep or

cow, according to his rank, is killed at the entrance of every village through which he passes. The throat of the animal is cut, and the blood allowed to flow across the path, so that his horse may step upon it. Perhaps even the head of the slaughtered animal is thrown across the road as he goes by. It is hoped that the Fates may be thus propitiated, and that any evil which might otherwise have overtaken him will be by these means averted and attracted to the beast. It is not always a cow or a sheep that is selected to take upon itself the evil which might befall a great man. At the marriage of a wealthy and powerful khan, I have heard that a beggar threw himself from a great height, and broke one of his limbs for the same purpose. The khan pensioned him handsomely.

If a Persian sneezes when he is about to do anything, he will not do it. The sneeze is looked upon as a warning.

The principles and practice of physic are much the same in Persia now as during the dark ages in Europe. The lungs of foxes are given for consumption, rose leaves for melancholy. The general average of longevity is from ten to fifteen years less than in England. Ignorant, savage, intolerant, superstitious, as they are, the Persians are extraordinarily ceremonious. They have even an art of getting up and an art of sitting down, which must in no case be infringed. The Persians do not sit cross-legged like the Turks. They sit upon their knees. To sit cross-legged is considered boorish, unless permission is first asked from the company. On getting up, it is necessary to rise without making any use of the hands. In no country are visits so strictly regulated, and so intolerable a nuisance, as in Persia. A man calls upon you to pass the morning, as if life had no other object than visiting, and as long as time was got rid of, it did not matter how. In conversation they speak low and soft to superiors and equals, loudly and haughtily to inferiors. The person employed to negotiate with Pasley, Sir John Malcolm's secretary, begged to be excused roaring at him in public, declaring that he was obliged to do so by his official rank. Their talk, which is at first amusing, soon becomes wearisome when one gets accustomed to it, and it is dreadfully troublesome in business. Their chief object in talking appears always to clothe nothing in fine phrases and roundabout language. They have a remarkable faculty of finding excuses, and always take the best answer they can invent, wholly irrespective of its truth or falsehood. Sometimes, however, they strike upon a quaint and original idea. 'If I make shoes to last,' said a cobbler to me, 'how am I to live?' And sometimes they hit upon a pretty thought. 'It is impossible,' said a Persian khan, alluding to a friend who, he was told, had slandered him: 'It is impossible that one I love so much should speak ill of me.' 'What do you mean,' said I once to

an ex-ambassador, who had passed a long time in Europe—‘what do you mean by the salutation, “May your shadow never be less?”’ ‘We live,’ answered the khan pleasantly, ‘under a very hot sun in Persia, and we retire to the shadow for repose and peace. The power of a great man gives rest and tranquillity to many, for none dare to injure or molest those whom he protects. So we call that power his shadow, and hope for our own sakes, as well as his, that it may never diminish.’

In spite of bad government, waste, and false ideas of every kind, Persia is still, perhaps, the most prosperous kingdom of the East. The state of agriculture in Persia, for instance, is far better than in Turkey, although it presents the same oriental picture of waste and unthrift. Field labour in Persia is chiefly performed by women. All crops in Persia must be artificially irrigated, as rain seldom falls there during the warm months of the year. The fact that the plains are nearly level facilitates the process. Water is taken by canals from the small rivers that roll down the mountains, and conveyed along near the foot of the declivities. Smaller canals, leading from the main ones, carry it down to prescribed sections of the plain; and these are again subdivided and conducted to particular fields, as it is needed. The openings from the main canals are readily closed when sufficient water is taken out for a given field, and the stream then passes on to cheer and fertilise the thirsty soil of the next neighbour. The ease with which the gardener changes these streams, by closing or opening a channel with his spade, or even with his foot, vividly illustrates the scriptural allusion to divine sovereignty: ‘The king’s heart is in the hand of the Lord as the rivers of water. He turneth it whithersoever He will.’ If the fields are not level, they must be divided and worked by a spade or plough into level sections, each enclosed within a ridge a few inches high; and these divisions are successively watered.

The water privileges are a great subject of contest, each farmer or landowner being entitled to a portion only on particular days or hours of the week; and it often happens towards the close of the summer, when the streams are low, that quarrels arise on the subject, the water being exhausted before it reaches the lower parts of the plain, and then there is a fight.

Where streams do not exist, or cannot be readily conducted, wells are in some cases dug, from which water is drawn with a bucket of skin upon a windlass turned by an ox, as in ancient Egypt. In other cases a well is sunk upon a descending plain till a spring is found, and a canal cut from the bottom underground, descending just enough to convey its water along; and a few yards from the first a second well is dug, that the

earth, in cutting the subterranean passage, may be drawn out; and the same process is repeated till the spring is conveyed to the surface, and made to irrigate the adjacent fields. The rapidity with which the wells are dug is surprising. Two men—one at the top, with a small hand windlass and a leather bucket to draw up the soil, and the other below with an iron prong, like a tusk furnished with a short handle, to dig it up, and a huge iron spoon with which to fill the bucket—will work down twenty to twenty-five feet per day; and the soil is so dry as to leave no curve nor wall to prevent it from passing. The grist mill is the only species of machinery moved by water in Persia. This is exceedingly simple in its construction, consisting merely of a perpendicular shaft with a water wheel attached to the bottom, and the upper millstone placed upon the top. Water is conveyed from the canal down to the buckets of the wheel by a large spout or trough, dug from the trunk of a tree very narrow at the surface, and often entirely covered over with pieces of board. This spout is placed at an angle of at least forty-five degrees, and, with a head of fifteen to twenty feet, it turns the wheel with prodigious rapidity and power. The Persians, having no means of bolting their flour, sift it with coarse sieves by hand. 'Two women grinding at the mill,' a small hand mill, is still a familiar scene in Persia among the peasants.

VULGAR FRACTIONS.

- (1) Multiply $\frac{4}{5}$ by 7; $\frac{3}{8}$ by 4; $\frac{7}{13}$ by 9; $\frac{11}{12}$ by 6; $\frac{13}{15}$ by 18; $\frac{4}{7}$ by 11.
- (2) $\frac{7}{15} \times 16$; $\frac{4}{11} \times 21$; $\frac{7}{25} \times 13$; $\frac{7}{11} \times 15$; $\frac{4}{31} \times 32$; $\frac{29}{37} \times 47$; $\frac{31}{13} \times 73$;
 $\frac{45}{94} \times 27$.
- (3) Divide $\frac{4}{11}$ by 8; $\frac{5}{14}$ by 6; $\frac{11}{12}$ by 9; $\frac{9}{17}$ by 5; $\frac{9}{13}$ by 12; $\frac{4}{14}$ by 13;
 $\frac{3}{5}$ by 16.
- (4) $\frac{13}{19} \div 15$; $\frac{7}{18} \div 28$; $\frac{19}{27} \div 37$; $\frac{12}{27} \div 38$; $\frac{39}{72} \div 12$; $\frac{39}{84} \div 13$; $\frac{45}{88} \div 16$;
 $\frac{45}{89} \div 27$.

Reduce to their simplest forms

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|--|---|
| (1) $\frac{4}{5}$ of $\frac{5}{8}$; $\frac{7}{9}$ of $\frac{9}{17}$. | (2) $\frac{5}{8}$ or $\frac{7}{11}$; $\frac{3}{4}$ of $\frac{4}{5}$. |
| (3) $\frac{9}{10}$ of $\frac{5}{9}$; $\frac{9}{15}$ of $\frac{5}{34}$. | (4) $3\frac{2}{3}$ of $5\frac{2}{3}$; $2\frac{1}{2}$ of $3\frac{2}{3}$. |
| (5) $7\frac{9}{11}$ of $\frac{2}{5}$ of $5\frac{9}{10}$ of $15\frac{1}{3}$. | (6) $17 \times 3\frac{1}{4}$ of $29\frac{11}{12}$ of $\frac{456}{1036}$. |

THE BATTLE OF HASTINGS.

(From 'The Norman Conquest,' by A. Thierry.)

lit'-an-y, a public form of supplication to God	roch'-et (Fr.), a surplice
hau'-berk, a coat of mail without sleeves	bat'-on, an official stick
	flank, the side of an army

rel'-ics, *remains*
 de-ci-mate, *to destroy one out of every*
ten
 dieu aide (Fr.), *God help us*
 ses-via-si-mre se-cu-res, *most cruel axes*
 No'-tre Dame (Fr.), *our Lady (the*
Virgin Mary)
 rav'-ine, *a deep narrow valley*

re-doubt', *a circular fort*
 strat'-a-gem, *a trick*
 quar'-ter, *mercy shown to the conquered*
 re-lent', *to give way*
 des-poil'-ed, *plundered*
 des-pond'-en-cy, *downheartedness*
 de-fl'-ien-cy, *want*

On the ground, which has ever since borne the name of Battle, the lines of the Anglo-Saxons occupied a long chain of hills, fortified by a rampart of stakes and willow hurdles. In the night of October 13 (1066), William announced to the Normans that the next day would be the day of battle. Priests and monks, who had followed the invading army in great numbers, attracted, like the soldiers, by the hope of booty, met to pray and chaunt litanies, while the warriors prepared their arms. The time which remained to them, after this first carol, was employed by them in confessing their sins and receiving the sacrament. In the other army, the night was passed in a very different manner; the Saxons diverted themselves with singing old national songs, and emptying, around their fires, horns filled with beer and wine.

When morning came, in the Norman camp, the Bishop of Bayeux, brother, on the mother's side, of Duke William, celebrated mass and blessed the troops, armed with a hauberk under his rochet; he then mounted a large white courser, took a baton of command, and drew up the cavalry. The army was divided into three columns of attack; in the first were the men-at-arms from the counties of Boulogne and Ponthieu, with most of the adventurers engaged individually for pay; in the second were the Breton, Manceaux, and Poitevin auxiliaries; William in person commanded the third, composed of the Norman chivalry. In front and on the flanks of each of these bodies were infantry, lightly armed, wearing quilted coats, and armed with long bows or with steel cross-bows. The duke was mounted on a Spanish charger, which a rich Norman had brought him on his return from a pilgrimage to St. Iago in Galicia. He wore around his neck the most revered of the relics upon which Harold had sworn, and the standard, blessed by the pope, was carried at his side by a young man, named 'Tonstain le Blanc.' At the moment, ere the troops began their march, the duke, raising his voice, thus addressed them:—

'Fight your best, and put every one to death; for if we conquer we shall all be rich. What I gain, you gain. If I conquer, you conquer. If I take the land, you will share it. Know, however, that I am not come here merely to take that which is my due, but to revenge our whole nation for the felon

acts, perjuries, and treason of these English. They put to death the Danes, men and women, in the night of St. Brice. They decimated the companions of my relation, Alfred, and put himself to death. On, then, in God's name, and chastise them for all their misdeeds.'

The army soon came in sight of the Saxon camp, north-west of Hastings. The priests and monks who accompanied it retired to a neighbouring hill, to pray and watch the combat. A Norman, named Taillefer, spurred his horse in front of the array, and began the song, famous throughout Gaul, of Charlemagne and Roland. As he sang, he played with his sword, throwing it far into the air, and catching it, as it fell, in his right hand; the Normans repeated the burthen, or shouted, *Dieu aide! Dieu aide!*

Coming within shot, the archers began to discharge their arrows, and the cross-bowmen their bolts; but most of the shots were rendered useless by the high parapets of the Saxon redoubts. The infantry, armed with lances, and the cavalry, advanced to the gates of the redoubts, and endeavoured to force them. The Anglo-Saxons, all on foot around their standard, planted in the ground, and forming behind their palisades a compact and solid mass, received their assailants with heavy blows of their axes, *savissimæ securæ*, as the historian calls them, one blow of which broke the lances and cut through the coats of mail. The Normans, not being able to penetrate the redoubts, or to tear up the stakes, fell back, fatigued with their useless attack, upon the division commanded by William. The duke then made all his archers advance, and ordered them not to shoot straight forward, but into the air, so that the arrows might fall into the enemy's camp. Many of the English were wounded, most of them in the face, by this manœuvre; Harold himself had his eye pierced with an arrow; but nevertheless continued to issue his orders and to fight. The attack of the infantry and cavalry again commenced, amid cries of *Notre Dame! Dieu aide! Dieu aide!* But the Normans were driven back from one of the gates of the camp, to a deep ravine, covered with brushwood and grass, the growth of time, into which they and their horses fell one upon the other, and thus perished in great numbers. There was a moment of terror in the foreign army. The report spread that the duke had been killed, and at this news a retreat commenced. William threw himself before the fugitives and barred their passage, threatening them, and striking them with his lance; then uncovering: 'I am here,' he exclaimed; 'look at me, I still live, and, with the help of God, I will conquer.'

The cavalry returned to the redoubts, but they could not

force the gates or make a breach; the duke then thought of a stratagem to induce the English to quit their position; he ordered a thousand of horse to advance and immediately retreat. The sight of this feigned flight made the Saxons lose their coolness; they all rushed in pursuit, their axes hanging from their necks. At a certain distance a body, previously disposed, joined the fugitives, who turned; and the English, surprised in their disorder, were assailed on every side by blows of lances and swords, from which they could not defend themselves, having both their hands occupied in wielding their great battle-axes. When they had lost their ranks, the redoubts were forced; horse and foot made their way into them, but the combat was still fierce, hand to hand. William had his horse killed under him; Harold and his two brothers fell dead at the foot of their standard, which was torn up and replaced by the banner sent from Rome. The wreck of the English army, without chief and without standard, prolonged the struggle to the end of the day, so late that the combatants of the two parties only recognised each other by their language.

Then, and not till then, did this desperate resistance end. Harold's followers dispersed, many dying upon the roads of their wounds and the fatigue of the combat. The Norman horse pursued them, granting quarter to none. The victors passed the night on the field of battle, and the next day at sunrise, Duke William drew up his troops and called over the names of all those who had crossed the sea with him, from the list which had been drawn up before their departure, at St. Valery. Numbers of these lay day dead or dying beside the conquered. The fortunate survivors had, for the first fruits of their victory, the spoils of the dead enemy. In turning over the bodies, thirteen were found with a monk's habit under their armour; they were the Abbott of Hyde, and his twelve companions; the name of their monastery was the first written in the black book of the conquerors.

The mothers and wives of those who had come from the neighbourhood to fight and die for their king, united to seek together and bring the bodies of their relations. That of King Harold lay for a long time on the field of battle, without any one daring to claim it. At length, Godwin's widow, Ghitha, subduing for a moment her grief, sent a message to Duke William, asking his permission to render the last honours to her son. She offered, say the Norman historians, to give the weight of his body in gold. But the duke sternly refused, saying that a man who had been false to his word and to his religion should have no other sepulchre than the sand of the shore. He relented, however, if we are to believe an old tradition, in favour of the monks of Waltham Abbey, which

Harold had founded and enriched. Two Saxon monks, Osgod and Ailrik, deputed by the Abbott of Waltham, demanded and obtained permission to transport the remains of their benefactor to their church. They sought among the mass of bodies, despoiled of arms and clothes, examining them carefully one after the other, but could not recognise the body of him they sought, so much had his wounds disfigured him. Despairing ever to succeed in their research unaided, they addressed themselves to a woman whom Harold, before he became king, had kept as a mistress, and entreated her to assist them. She was called Edith, and surnamed the Beauty with the swan's neck. She consented to accompany the two monks, and was more successful than they in discovering the corpse of him whom she had loved.

All these events are related by the chroniclers of Anglo-Saxon race, in a tone of despondency which it is difficult to convey. They call the day of battle a bitter day, a day of death, a day stained with the blood of the brave. 'England, what shall I say of thee,' exclaims the historian of the Church of Ely; 'What shall I relate to our descendants? Woe to thee! thou hast lost thy national king, and thou hast fallen into the hands of the foreigner; thy sons have perished miserably, thy councillors and thy chiefs are conquered, dead, or disinherited.' Long after the day of this fatal fight, patriotic superstition still saw traces of fresh blood upon the ground where it had taken place; they were visible, it was said, on the heights north-west of Hastings, when a slight rain had moistened the soil. Immediately after his victory, William made a vow to build an abbey on the spot, dedicated to the Holy Trinity and St. Martin, the patron of the warriors of Gaul. The vow was soon accomplished, and the high altar of the new monastery was raised on the very spot where the standard of King Harold had been planted and torn down. The outer walls were traced around the hill which the bravest of the English had covered with their bodies, and the whole extent of the adjacent land, upon which the famous scenes of the battle had taken place, became the property of this abbey, which was called, in the Norman language, *L'Abbaye de la Bataille*. Monks from the great convent of Marmoutiers, near Tours, came to settle here and pray for the souls of all who had died on the field.

It is said that, when the first stones of the edifice were laid, the architects discovered that there would be a deficiency of water; they went, quite disconcerted, to acquaint William with this untoward circumstance: 'Work, work away,' replied *the conqueror*, in a jovial tone, 'for if God give me life, there

shall be more wine among the monks of Battle Abbey than there is water in the best convent of Christendom.'

ADDITION OF VULGAR FRACTIONS.

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|--|---|
| (1) $\frac{2}{8} + \frac{1}{5} + \frac{3}{6}$ | (2) $\frac{3}{4} + \frac{1}{3} + \frac{5}{6}$ |
| (3) $\frac{9}{10} + \frac{1}{11} + \frac{7}{9}$ | (4) $1\frac{1}{2} + 2\frac{1}{3} + 3\frac{2}{11}$ |
| (5) $5\frac{2}{3} + 6\frac{1}{18} + 12\frac{1}{2}$ | (6) $4\frac{9}{20} + 20\frac{3}{15} + 1\frac{1}{12}$ |
| (7) $19\frac{1}{3} + 11\frac{13}{30} + 8\frac{5}{6}$ | (8) $4 + 3\frac{19}{21} + 4\frac{4}{7}$ |
| (9) $11\frac{1}{5} + 12\frac{8}{9} + 13\frac{1}{18} + \frac{1}{36} + 1\frac{1}{4}$ | (10) $24\frac{19}{37} + 11 + 3\frac{1}{13} + 4\frac{2}{5} + \frac{29}{36} + 5\frac{5}{6}$ |
| (11) $4\frac{1}{5} + 12\frac{1}{6} + 9\frac{9}{18} + 11\frac{1}{17}$ of $5\frac{1}{8}$ | (12) $\frac{5}{8}$ of $2\frac{1}{2} \times 3\frac{4}{5}$ |
| (13) $3\frac{1}{2}$ of $4\frac{1}{2} + \frac{1}{2} \times \frac{1}{16}$ | (14) $7\frac{1}{2} + 11\frac{1}{2} + \frac{9}{11}$ |
| (15) $3\frac{1}{4}$ of $5\frac{1}{2} + \frac{1}{12}$ | (16) $3\frac{1}{7}$ of $2\frac{1}{3} + 5\frac{1}{18} + 9\frac{9}{10} + \frac{1}{12} + 8\frac{5}{6}$ |

COOKING FLESH MEAT.

(From 'Chemistry of Common Life,' by Professor Johnson.)

c-vap'-o-ra-ted, driven off in vapour
sa-line', partaking of the nature of salt
so-lu'-tion, the liquid in which any sub-
stance is dissolved
fil'-bres, threads
pores, small holes
co-ag'-u-late, to become thick or solid: to
clot
di-lu'-ted, mixed with water, weakened
un-sa'-vour-y, having no agreeable taste
or odour

top'-id, moderately warm
con-trac'-tion, the act of drawing to-
gether, or lessening in bulk
ex-clu'-sion, the act of shutting out
dim-in-u'-tion, a lessening
nu'-tri-tive, nourishing
kre'-a-tin, a peculiar substance found in
the juice of meat
phos-phor'-ic, relating to, or formed of,
phosphorus

IN cooking animal food, plain boiling, roasting, and baking are in most general favour in our islands. During these operations with fresh beef and mutton, when moderately fat, the average loss in weight is as follows:—

	in boiling	in baking	in roasting
4 lbs. of beef lose	1 lb.	1 lb. 3 oz.	1 lb. 5 oz.
4 lbs. of mutton lose	14 oz.	1 lb. 4 oz.	1 lb. 6 oz.

The greater loss in baking and roasting arises chiefly from the greater quantity of water which is evaporated, and of fat which is melted out during these two methods of cooking. Two circumstances, however, have much influence upon the successful result of these and some other modes of cooking.

If we put moist flesh meat into a press and squeeze it, a red liquid will flow out. This is water, coloured by blood, and holding various saline and other substances in solution. Or, if, after being cut very thin, or chopped very fine, the flesh be put into a limited quantity of clean water, the juices of the meat will be gradually extracted, and by subsequent pressure will be more completely removed from it than when pressure is applied to it in the natural state, and without any such mincing and steeping. The removal of these juices leaves the beef or mutton nearly tasteless.

When the juice of the meat, extracted in either way, is heated nearly to boiling, it thickens or becomes muddy, and flakes of whitish matter separate, which resemble boiled white of egg. They are, in fact, white of egg, or albumen, and they show that the juice of flesh contains a certain quantity of this substance in the same liquid and soluble state in which it exists in the unboiled egg. Now the presence of this albumen in the juice of butchers' meat is of much importance in connection with the skilful preparation of it for the table.

The first effect of the application of a quick heat to a piece of fresh meat is to cause the fibres to contract, to squeeze out a little of the juice, and to a certain extent to close up the pores so as to prevent the escape of the remainder. The second is to coagulate the albumen contained in the juice, and thus effectually and completely to plug up the pores, and to retain within the meat the whole of the internal juice. Thereafter the cooking goes on through the agency of the natural moisture of the flesh. Converted into vapour by the heat, a kind of steaming takes place within the piece of meat, so that whether in the oven, on the spit, or in the midst of boiling water, it is in reality, when skilfully done, cooked by its own steam.

A well-cooked piece of meat should be full of its own juice or natural gravy. In roasting, therefore, it should be exposed to a quick fire, that the external surface may be made to contract at once, and the albumen to coagulate, before the juice has had time to escape from within. And so in boiling. When a piece of beef or mutton is plunged into boiling water, the outer part contracts, the albumen which is near the surface coagulates, and the internal juice is prevented either from escaping into the water by which it is surrounded, or from being diluted and weakened by the admission of water among it. When cut up, therefore, the meat yields much gravy, and is rich in flavour. Hence a beef-steak or a mutton-chop is done quickly and over a quick fire, that the natural juices may be retained. On the other hand, if the meat be exposed to a slow fire its pores remain open, the juice continues to flow from within as it is dried from the surface, and the flesh pines and becomes dry, hard, and unsavoury. Or if it be put into cold or tepid water, which is afterwards gradually brought to a boil, much of the albumen is extracted before it coagulates, the natural juices for the most part flow out, and the meat is served in a nearly tasteless state. Hence, to prepare good boiled meat, it should be put at once into water already brought to a boil. But to make beef tea, mutton broth, or other meat soups, the flesh should be put into cold water, and this afterwards very slowly warmed, and finally boiled. The advantage derived from *simmering*—a term not unfrequent in cookery

books—depends very much upon the effects of slow boiling, as above explained. . . .

The application of salt to fresh meat has very much of the same effect as the application of a quick heat. It causes the fibres to contract, the meat to lessen in bulk, and the juice to flow out from its pores. Hence the reason why dry salt strewed upon fresh lean meat gradually dissolves into a fluid brine. The effect of the salt, if a large quantity be applied, penetrates deep, so that as much as one-third of the juice of the meat is often forced out by the contraction of the fibres. The effect of this upon the meat is twofold. It diminishes the natural flavour by removing a large proportion of the peculiar substances contained in the juice, and adding pure salt in their stead. At the same time it closes up the pores of the meat, and prevents the entrance of atmospheric air, thus diminishing the liability to decay.

The preservation of fresh meat by salting depends, therefore, upon the separation of water, upon the exclusion of air, upon the saturation with salt of the juice which remains in the meat, and upon the formation of a weak compound of the flesh with common salt, which does not readily undergo decay. But this preservation is attended by a diminution in its nutritive qualities; for the juice which flows out contains albumen (white of egg), kreatin, phosphoric acid, and potash. These substances are precisely the same as are more fully extracted by water, in the method of making savory beef tea as already described; and in proportion as they are extracted they diminish the nutritive properties of the meat. Hence one reason why long feeding on salt meat affects the health, and why vegetable and other substances, which are capable of supplying what the meat had lost, are found to be the best means of restoring it.

As a whole, flesh meat is eminently nutritious, because it contains *all* the materials which are necessary to build up our own flesh; but remove from it a portion of these materials, and the remainder become more or less useless—as bricks and stone become useless to the builder if we refuse him the requisite quantity of mortar.

SUBTRACTION OF VULGAR FRACTIONS.

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| (1) $\frac{3}{4} - \frac{2}{5} = \frac{15}{20} - \frac{8}{20} = \frac{7}{20}$ | (2) $\frac{1}{2} - \frac{1}{3} = \frac{11}{12} - \frac{4}{12} = \frac{7}{12}$ |
| (3) $\frac{9}{10} - \frac{1}{5} = \frac{9}{10} - \frac{2}{10} = \frac{7}{10}$ | (4) $\frac{1}{15} - \frac{1}{20} = \frac{4}{60} - \frac{3}{60} = \frac{1}{20}$ |
| (5) $1\frac{5}{18} - \frac{1}{9} = 1\frac{5}{18} - \frac{2}{18} = 1\frac{3}{18} = 1\frac{1}{6}$ | (6) $5\frac{11}{13} - 3\frac{11}{13} = 2\frac{0}{13} = 2$ |
| (7) $5\frac{17}{17} - 3\frac{7}{17} = 2\frac{10}{17}$ | (8) $6\frac{13}{20} - 3\frac{13}{20} = 3$ |
| (9) $3\frac{1}{2} + 2\frac{1}{4} = 5\frac{3}{4}$ of $\frac{5}{8}$ | (10) $8\frac{1}{2} + 15\frac{1}{2} = 24$ of $\frac{2}{3}$ of $\frac{2}{3}$ |
| (11) $9\frac{11}{14} - 6\frac{13}{14} = 3\frac{11}{14} - \frac{13}{14} = 2\frac{11}{14}$ | (12) $8\frac{7}{8} - 5\frac{13}{16} = 8\frac{14}{16} - 5\frac{13}{16} = 3\frac{1}{16}$ |
| (13) $5\frac{7}{8} + \frac{1}{2} = 5\frac{7}{8} + \frac{4}{8} = 6\frac{11}{8} = 7\frac{3}{8}$ | (14) $8\frac{1}{2} - (\frac{3}{5} + \frac{4}{5} + \frac{2}{5}) = 8\frac{1}{2} - \frac{9}{5} = 8\frac{1}{2} - 1\frac{4}{5} = 7\frac{1}{10}$ |
| (15) $198 - 45\frac{11}{12} = 152\frac{11}{12}$ | (16) $833\frac{1}{17} - 34\frac{11}{17} = 799$ |
| (17) $6\frac{1}{2}$ of $4\frac{1}{2} - \frac{2}{10} = 24\frac{1}{2} - \frac{1}{5} = 24\frac{4}{5}$ | (18) $843 - (\frac{1}{3} + \frac{1}{4} + \frac{3}{15}) = 843 - \frac{11}{12} = 842\frac{11}{12}$ |
| (19) $\frac{1}{3}$ of $\frac{1}{4} - \frac{1}{12} = \frac{1}{12}$ | (20) $76\frac{1}{7} - 11\frac{7}{10} = 65\frac{13}{70}$ |

THANKFULNESS FOR WORLDLY BLESSINGS.

(From 'The Complete Angler,' by Izaak Walton.)

pre-vent', to come before
 oor-ro'-ding, rusting, eating away as
 rust does
 un-con'-scion-a-bly, unreasonably
 oom'-pe-tence, a sufficiency
 al-lot'-ted, portioned out

Di-o'-ge-nes, an ancient Greek philo-
 sopher who lived in a tub, and whose
 extreme poverty was his boast. Died,
 B.C. 324
 tur'-bu-lent, violent, noisy
 pe'-ri-od, an end

[Izaak Walton, one of the best early English writers, was a linendraper in London. His chief works are, 'The Complete Angler; or Contemplative Man's Recreation;' and the lives of Dr. Donne, Sir Henry Wotton, Richard Hooker, George Herbert, and Bishop Sanderson. Born, 1593; died, 1683.]

WELL, scholar, having now taught you to paint your rod, and we having still a mile to Tottenham High Cross, I will, as we walk towards it in the cool shade of this sweet honeysuckle hedge, mention to you some of the thoughts and joys that have possessed my soul since we met together. And these thoughts shall be told you, that you also may join with me in thankfulness to the Giver of every good and perfect gift, for our happiness. And that our present happiness may appear to be the greater, and we the more thankful for it, I will beg you to consider with me, how many do, even at this very time, lie under the torment of the stone, the gout, and toothache; and this we are free from. And every misery that I miss is a new mercy, and therefore let us be thankful. There have been, since we met, others that have met disasters of broken limbs; some have been blasted, others thunder-stricken, and we have been freed from these and all those many other miseries that threaten human nature: let us therefore rejoice and be thankful. Nay, which is a far greater mercy, we are free from the insupportable burden of an accusing, tormenting conscience—a misery that none can bear; and therefore let us praise Him for his preventing grace, and say, Every misery that I miss is a new mercy. Nay, let me tell you, there be many that have forty times our estates, that would give the greater part of it to be healthful and cheerful like us—who, with expense of a little money, have eat, and drank, and laughed, and angled, and sung, and slept securely; and rose next day and cast away care, and sung, and laughed, and angled again; which are blessings rich men cannot purchase with all their money. Let me tell you, scholar, I have a rich neighbour that is always so busy that he has no leisure to laugh; the whole business of his life is to get money, and more money; he is still drudging on that he may still get more and more money; and says that Solomon says, 'The hand of the diligent maketh rich;' and it is true indeed; but he considers not that it is not in the power of riches to make a man happy; for it was wisely said by a man of great

observation, that 'there be as many miseries beyond riches as on this side them.'

And yet, God deliver us from pinching poverty, and grant that, having a competency, we may be content and thankful! Let us not repine, or so much as think the gifts of God unequally dealt, if we see another abound with riches, when, as God knows, the cares that are the keys that keep those riches hang often so heavily at the rich man's girdle, that they clog him with weary days and restless nights, even when others sleep quietly. We see but the outside of the rich man's happiness; few consider him to be like the silkworm, that, when she seems to play, is at the very same time spinning her own bowels, and consuming herself; and this many rich men do, loading themselves with corroding cares, to keep what they have, probably unconscionably got. Let us, therefore, be thankful for health and a competence, and, above all, for a quiet conscience.

Let me tell you, scholar, that Diogenes walked on a day with his friend to see a country fair, where he saw ribbons, and looking-glasses, and nut-crackers, and fiddles, and hobby-horses, and many other gimcracks; and, having observed them and all the other finnimbruns that make a complete country fair, he said to his friend—'Lord, how many things are there in this world of which Diogenes hath no need!' And truly it is so, or might be so, with very many who vex and toil themselves to get what they have no need of.

Can any man charge God that he hath not given him enough to make his life happy? No, doubtless: for nature is content with a little. And yet you shall hardly meet with a man that complains not of some want, though he, indeed, wants nothing but his will; it may be, nothing but his will of his poor neighbour, for not worshipping him or not flattering him; and thus, when we might be happy and quiet, we create trouble to ourselves. I have heard of a man that was angry with himself because he was no taller, and of a woman that broke a looking-glass because it would not show her face to be as young and handsome as her next neighbour's was. And I knew another to whom God had given health and plenty, but a wife that nature had made peevish, and her husband's riches had made purse-proud; and must, because she was rich, and for no other virtue, sit in the highest pew in the church; which being denied her, she engaged her husband into a contention for it, and at last into a law-suit with a dogged neighbour who was as rich as he, and had a wife as peevish and purse-proud as the other; and this law-suit begot higher oppositions and actionable words, and more vexations and law-suits; for you must remember that both were rich, and must therefore have their wills. Well, this wilful, purse-proud law-suit lasted during the life of the

first husband, after which his wife vexed and chid, and chid and vexed, till she also chid and vexed herself into her grave : and so the wealth of these poor rich people was cursed into a punishment, because they wanted meek and thankful hearts, for those only can make us happy. I knew a man that had health and riches, and several houses, all beautiful and ready furnished, and would often trouble himself and family to be removing from one house to another ; and being asked by a friend why he removed so often from one house to another, replied, ' It was to find content in some one of them.' But his friend, knowing his temper, told him, if he would find content in any of his houses, he must leave himself behind him ; for content will never dwell but in a meek and quiet soul. And this may appear, if we read and consider what our Saviour says in St. Matthew's gospel ; for he there says, ' Blessed be the merciful, for they shall obtain mercy. Blessed be the pure in heart, for they shall see God. Blessed be the poor in spirit, for theirs is the kingdom of heaven. And blessed be the meek, for they shall possess the earth.' Not that the meek shall not also obtain mercy, and see God, and be comforted, and at last come to the kingdom of heaven ; but, in the meantime, he and he only possesses the earth, as he goes toward that kingdom of heaven, by being humble, and cheerful, and content with what his good God has allotted him. He has no turbulent, repining, vexatious thoughts that he deserves better, nor is vexed when he sees others possessed of more honour or more riches than his wise God has allotted for his share ; but he possesses what he has with a meek and contented quietness, such a quietness as makes his very dreams pleasing, both to God and himself.

My honest scholar, all this is told to incline you to thankfulness ; and to incline you the more, let me tell you, that though the prophet David was guilty of murder and adultery, and many other of the most deadly sins, yet he was said to be a man after God's own heart, because he abounded more with thankfulness than any other that is mentioned in holy Scripture ; as may appear in his book of Psalms, where there is such a commixture of his confessing of his sins and unworthiness, and such thankfulness for God's pardon and mercies, as did make him to be accounted, even by God himself, to be a man after his own heart : and let us, in that, labour to be as like him as we can ; let not the blessings we receive daily from God make us not to value, or not praise him, because they be common ; let us not forget to praise him for the innocent mirth and pleasure we have met with since we met together. What would a blind man give to see the pleasant rivers, and meadows, and flowers, and fountains that we have met with since we met together ? *I have been told that if a man that was born blind could obtain*

to have his sight for but only one hour during his whole life, and should, at the first opening of his eyes, fix his eyes upon the sun when it was in his full glory, either at the rising or setting of it, he would be so transported and amazed, and so admire the glory of it, that he would not willingly turn his eyes from that first ravishing object to behold all the other various beauties this world could present to him. And this, and many other like blessings, we enjoy daily. And for most of them, because they be so common, most men forget to pay their praises; but let not us, because it is a sacrifice so pleasing to Him that made that sun and us, and still protects us, and gives us flowers, and showers, and stomachs, and meat, and content, and leisure to go a-fishing.

Well, scholar, I have almost tired myself, and, I fear, more than almost tired you. But I now see Tottenham High Cross, and our short walk thither will put a period to my too long discourse, in which my meaning was, and is, to plant that in your mind with which I labour to possess my own soul—that is, a meek and thankful heart. And to that end I have showed you that riches without them (meekness and thankfulness) do not make any man happy. But let me tell you, that riches with them remove many fears and cares. And therefore my advice is, that you endeavour to be honestly rich, or contentedly poor; but be sure that your riches be justly got, or you spoil all; for it is well said by Caussin, ‘He that loses his conscience has nothing left that is worth keeping.’ Therefore be sure you look to that. And, in the next place, look to your health, and if you have it praise God, and value it next to a good conscience; for health is the second blessing that we mortals are capable of—a blessing that money cannot buy,—and therefore value it, and be thankful for it. As for money (which may be said to be the third blessing), neglect it not, but note, that there is no necessity of being rich; for I told you there be as many miseries beyond riches as on this side them; and if you have a competence, enjoy it with a meek, cheerful, thankful heart. I will tell you, scholar, I have heard a grave divine say that God has two dwellings, one in heaven, and the other in a meek and thankful heart, which Almighty God grant to me and to my honest scholar! And so you are welcome to Tottenham High Cross.

MULTIPLICATION OF VULGAR FRACTIONS.

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| (1) $\frac{3}{4} \times \frac{7}{8}; \frac{9}{10} \times \frac{2}{3}.$ | (2) $6\frac{1}{2} \times 7\frac{1}{2}; 4\frac{2}{3} \times 3\frac{1}{11}.$ |
| (3) $8\frac{9}{11} \times 9\frac{3}{5}.$ | (4) $3\frac{7}{10} \times 5\frac{3}{8}.$ |
| (5) $7\frac{1}{2} \times \frac{5}{6} \times 2\frac{9}{11} \times \frac{6}{7}.$ | (6) $8\frac{3}{4} \times 3\frac{1}{2} \times 7\frac{1}{8} \times \frac{9}{12}.$ |
| (7) $7\frac{1}{3}$ of $8\frac{1}{4} \times 6\frac{9}{10} \times \frac{10}{11}.$ | (8) $8\frac{3}{4} \times \frac{7}{8} + (\frac{2}{5} + 1\frac{5}{6}).$ |
| (9) $7\frac{1}{2} \times 4\frac{2}{3} - (\frac{1}{5} \text{ of } \frac{9}{10}).$ | (10) $\frac{4}{5}$ of $\frac{7}{8} \times (\frac{2}{3} + 4\frac{1}{2}).$ |
| (11) $\frac{2}{7} \times 5\frac{1}{2} \times \frac{1}{3}$ of $\frac{9}{5}.$ | (12) $9\frac{1}{11} \times 7\frac{1}{8} \times \frac{5}{6}$ of $\frac{3}{16}.$ |
| (13) $71\frac{5}{10} \times \frac{7}{8} + (\frac{1}{2} - \frac{5}{16}).$ | (14) $5\frac{1}{10} \times 7\frac{1}{8} \times \frac{5}{6}$ of $\frac{5}{8}.$ |
| (15) $7\frac{3}{10}$ of $2\frac{1}{2} \times (\frac{7}{8} + \frac{10}{11}).$ | (16) $8\frac{3}{8}$ of $5 \times (4\frac{3}{4} + \frac{3}{8}).$ |

A NEGRO QUEEN-DOWAGER.

(From 'The Discovery of the Source of the Nile,' by Captain Speke.)

lev'-ee, a ceremonial visit of nobility,
etc., to a king or queen, which in Eng-
 land is attended by men only
 meer'-schaum, a fine sort of Turkish
 clay
 pom'-bé, plantain wine
 con'-cert, agreement
 ad'-vent, arrival
 ap-pre'-ci-ate, to value properly
 a-skance', sideways
 ex-che'-quer, the treasury

U-gan'-da, a country of Africa, on the
 Equator, N.W. of Lake Victoria Nyanza
 N'y-an-xig-ging, a mode of returning
 thanks, accompanied by violent motions
 of the hands and body
 mbu'-gu, a sort of native cloth
 hi-lar'-i-ty, noisy mirth
 af'-fect', to pretend
 pan-de-mo'-ni-um, the council chamber
 of the fallen angels; hell

[The source of the Nile had been a puzzle to geographers for ages. To set the matter at rest, Captains Speke and Grant left Portsmouth, April 27, 1860; arrived at Zanzibar, an island on the E. coast of Africa on Aug. 15 following; leaving which place on Sept. 21, they crossed to the mainland with a large party of guides, soldiers, and porters, carrying a great quantity of cloth, beads, toys, guns, &c., as presents to the kings and chiefs through whose territories they might pass. They arrived at Ripon Falls, where the Nile first issues from Lake Victoria Nyanza, on July 28, 1862.]

I WAS shown in at once, and found her majesty sitting on an Indian carpet, dressed in a red linen wrapper, with a gold border, and a box, in the shape of a lady's work-box, prettily coloured in divers patterns with minute beads, by her side. Her councillors were in attendance; and in the yard a band of music, with many minor Wakungu squatting in a semicircle, completed her levee. Maüla, on my behalf, opened conversation, in allusion to her yesterday's question, by saying I had applied to Mtesa (the young king) for a palace, that I might be near enough to both their majesties to pay them constant visits. She replied, in a good hearty manner, that that indeed was a very proper request, which showed my good sense, and ought to have been complied with at once; but Mtesa was only a Kijana, or stripling, and as she influenced all the government of the country, she would have it carried into effect. Compliments were now passed, my presents given and approved of; and the queen, thinking I must be hungry, for she wanted to eat herself, requested me to refresh myself in another hut. I complied, spread my bedding, and ordered in my breakfast; but as the hut was full of men, I suspended a Scotch plaid, and quite eclipsed her mbügü curtain.

Reports of this magnificence at once flew to the queen, who sent to know how many more blankets I had in my possession,

and whether if she asked for one she would get it. She also desired to see my spoons, forks, and pipe (an English meerschau, mounted with silver); so, after breakfast, I returned to see her, showed her the spoons and forks, and smoked my pipe, but told her I had no blankets left but what formed my bed. She appeared very happy and very well, did not say another word about the blankets, but ordered a pipe for herself, and sat chatting, laughing, and smoking in concert with me.

I told her I had visited all the four quarters of the globe, and had seen all colours of people, but wondered where she got her pipe from, for it was much after the Rûmish (Turkish) fashion, with a long stick. Greatly tickled at the flattery, she said, 'We hear men like yourself come to Amara from the other side, and drive cattle away.' 'The Gallas, or Abyssinians, who are tall and fair, like Rûmanika,' I said, 'might do so, for they live not far off on the other side of Amara, but we never fight for such paltry objects. If cows fall into our hands when fighting, we allow our soldiers to eat, while we take the government of the country into our own hands.' She then said, 'We hear you don't like the Unyamûezi route; we will open the Ukori one for you.' 'Thank your majesty,' said I, in a figurative kind of speech to please Waganda ears; and turning the advantage of the project on her side, 'You have, indeed, hit the right nail on the head. I do not like the Unyamûezi route, as you may well imagine when I tell you I have lost so much property there by mere robbery of the people and their kings. The Waganda do not see me in a true light; but if they have patience for a year or two, until the Ukori road is open, and trade between our respective countries shall commence, they will then see the fruits of my advent; so much so, that every Mganda will say the first Uganda year dates from the arrival of the first Msungû (white) visitor. As one coffee-seed sown brings forth fruit in plenty, so my coming here may be considered.' All appreciated this speech, saying, 'The white man, he even speaks beautifully! beautifully! beautifully! beautifully!' and, putting their hands to their mouths, they looked askance at me, nodding their admiring approval. The queen and her ministers then plunged into pombé and became uproarious, laughing with all their might and main. Small bugu cups were not enough to keep up the excitement of the time, so a large wooden trough was placed before the queen and filled with liquor. If any was spilt, the Wakungû instantly fought over it, dabbing their noses on the ground, or grabbing it with their hands, that not one atom of the queen's favour might be lost; for everything must be adored that comes from royalty, whether by design or accident.

The queen put her head to the trough and drank like a pig from it, and was followed by her ministers. The band, by order, then struck up a tune called the Milele, playing on a dozen reeds, ornamented with beads and cow-tips, and five drums, of various tones and sizes, keeping time. The musicians, dancing with zest, were led by four bandmasters, also dancing, but with their backs turned to the company to show off their long, shaggy, goat-skin jackets, sometimes upright, at other times bending and on their heels, like the hornpipe dancers of western countries. It was a merry scene, but soon became tiresome; when Bombay, by way of flattery, and wishing to see what the queen's wardrobe embraced, told her, 'Any woman, however ugly, would assume a goodly appearance if prettily dressed;' upon which her gracious majesty immediately rose, retired to her toilet-hut, and soon returned attired in a common check cloth, an abrus tiara, a bead necklace, and with a folding looking-glass, when she sat, as before, and was handed a blown-glass cup of pombé, with a cork floating on the liquor, and a napkin mbügü covering the top, by a virgin. For her kind condescension in assuming plain raiment, everybody, of course, n'yanzigged. Next she ordered her slave girls to bring her a large number of sambo (anklets), and begged me to select the best, for she liked me much. In vain I tried to refuse them; she had given more than enough for a keepsake before, and I was not hungry for property; still I had to choose some, or I would give offence. She then gave me a basket of tobacco, and a nest of hen's eggs for her 'son's' breakfast. When this was over, the Mükondéri, another dancing-tune, with instruments something like clarionets, was ordered; but it had scarcely been struck up, before a drenching rain, with strong wind, set in and spoilt the music, though not the playing, for none dared stop without an order; and the queen, instead of taking pity, laughed most boisterously over the exercise of her savage power as the unfortunate musicians were nearly beaten down by the violence of the weather.

When the rain ceased, her majesty retired a second time to her toilet-hut, and changed her dress for a puce-coloured wrapper, when I, ashamed of having robbed her of so many sambo, asked if she would allow me to present her with a little English 'wool,' to hang up instead of her mbügü curtain on cold days like this. Of course she could not decline, and a large double scarlet blanket was placed before her. 'Oh, wonder of wonders!' exclaimed all the spectators, holding their mouths in both hands at a time. Such a 'pattern' had never been seen here before. It stretched across the hut, was *higher than the men could reach*, indeed it was a perfect

marvel; and the man must be a good one who brought such a treasure as this to Uddü. Uganda is personified by Mtéssa; and no one can say he has seen Uganda until he has been presented to the king.

As I had them all in a good humour now, I complained I did not see enough of the Waganda, and as everyone dressed so remarkably well, I could not discern the big men from the small; could she not issue some order by which they might call on me, as they did not dare to do so without instructions, and then I in turn would call upon them. Hearing this, she introduced me to her prime minister, chancellor of exchequer, women keepers, hangmen, and cooks, as the first nobles in the land, that I might recognise them again if I met them on the road. All n'yanzigged for this great condescension, and said they were delighted with their guest; then producing a strip of common joho to compare it with my blanket, they asked if I could recognise it. 'Of course,' said I, 'it is made in my country, of the same material, only of coarser quality, and everything of the same sort is made in Usungü (England).' 'Then, indeed,' said the whole company with one voice, 'We do like you, and your cloth too, but you most.' I modestly bowed my head, and said their friendship was my chief desire.

This speech also created great hilarity; the queen and councillors all became uproarious. The queen began to sing, and the councillors to join in chorus; then all sang and all drank, and drank and sang, till in their heated excitement they turned the palace into a pandemonium; still there was not noise enough, so the band and drums were called again, and tom-fool—for Uganda, like the old European monarchies, always keeps a jester—was made to sing in the gruff, hoarse, unnatural voice which he ever affects to maintain his character, and was furnished with pombé when his throat was dry.

Now, all of a sudden, as if a devil had taken possession of the company, the prime minister with all the courtiers jumped upon their legs, seized their sticks, for nobody can carry a spear when visiting, swore the queen had lost her heart to me, and running into the yard, returned, charging and jabbering at the queen; retreated and returned again, as if they were going to put an end to her for the guilt of loving me; but really to show their devotion and true love to her. I was now getting very tired of sitting on my low stool, and begged for leave to depart, but N'yamasoré would not hear of it; she loved me a great deal too much to let me go away at this time of day, and forthwith ordered in more pombé. The same roystering scene was repeated; and the queen graced it by drinking, pig-fashion, first, and then handing it round to the company.

DIVISION OF VULGAR FRACTIONS.

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|---|---|
| (1) $\frac{7}{18} \div \frac{9}{24} = \frac{5}{9} \div \frac{7}{15}$. | (2) $\frac{7}{11} \div \frac{7}{23} = \frac{4}{11} \div \frac{9}{11}$. |
| (3) $9\frac{1}{3} \div 4\frac{1}{5}$. | (4) $3\frac{5}{8} \div 3\frac{3}{8}$. |
| (5) $\frac{9}{17} \div \frac{5}{19} = \frac{17}{16} \div 3\frac{1}{5}$. | (6) $9\frac{7}{9} \div 8\frac{1}{2} = 4\frac{1}{7} \div 3\frac{7}{11}$. |
| (7) $8\frac{5}{6} \div 4\frac{1}{4}$. | (8) $5\frac{9}{10} \div 4\frac{1}{10}$. |
| (9) $45\frac{11}{18} \div 21\frac{1}{6} = 3\frac{1}{5} \div 4\frac{1}{8}$. | (10) $56\frac{9}{10} \div 9\frac{11}{12} = 3\frac{2}{3} \div 4\frac{1}{8}$. |
| (11) $4\frac{2}{5} \div 91\frac{7}{8}$. | (12) $61\frac{5}{8} \div 87\frac{9}{10}$. |
| (13) $\frac{3}{5} \div (\frac{5}{6} \times \frac{7}{8} \text{ of } \frac{4}{9} \text{ of } \frac{9}{10})$. | (14) $78\frac{5}{8} \div (\frac{11}{12} \text{ of } \frac{12}{13} - \frac{1}{3})$. |
| (15) $\frac{9}{20} \div 1\frac{17}{27}$. | (16) $9\frac{19}{24} \div 11\frac{11}{24}$. |

Reduce to their simplest forms

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|---|---|
| (17) $\frac{5}{3\frac{1}{3}}; \frac{8\frac{1}{7}}{5}; \frac{2\frac{1}{8}}{4\frac{1}{8}}; \frac{3}{2\frac{1}{2}}; \frac{7\frac{9}{10}}{8\frac{1}{11}}$. | (18) $\frac{17\frac{2}{3}}{18\frac{1}{6}} \text{ of } \frac{9}{15}; \frac{5\frac{1}{8}}{6\frac{2}{3}} \text{ of } \frac{7}{8} \text{ of } \frac{5}{35}$. |
| (19) $3\frac{3}{4} \text{ of } \frac{4\frac{1}{8}}{3\frac{1}{3}}$. | (20) $\frac{7\frac{1}{16} \text{ of } \frac{9}{11}}{2\frac{1}{8} \text{ of } 1\frac{1}{4}} \div \frac{4}{7} \text{ of } \frac{5}{8}$. |

OPPRESSION OF THE PEOPLE UNDER THE NORMANS.

(From 'History of England,' by G. L. Craik.)

an'-arch-y, *confusion, want of government*
 su-pren'-a-cy, *the height of authority, &c.*
 aug-men-ta'-tion, *an increase*
 pre-cip-i-tate, *headlong, hasty*
 sal'-u-tar-y, *wholesome, good for the health*
 neu'-tral-ise, *to render neutral, or neither one thing nor another*
 de-base'-ment, *the act of making bad*

pur-vey'-or, *one who supplies provisions*
 con-temp'-o-ra-ry, *living at the same time*
 pre-de-ced'-sor, *one who has gone before*
 ra-pa'-ci-ty, *eagerness for plunder, robbery*
 de-lin'-quent, *an offender*
 cro'-sier-ed, *holding a crozier or bishop's staff*
 per-turb-a'-tion, *disturbance*

[The Norman line of kings governed England eighty-eight years—viz., from William the Conqueror, 1066, to the death of Stephen, 1154.]

BOTH the Conqueror and his son Henry have the character of having been strict administrators of the laws, and rigorously exact and severe in the punishment of offences against the public peace. The Saxon chronicler says that, in the time of the former, a girl loaded with gold might have passed safely through all parts of the kingdom. In like manner, the same authority tells us, that, under the government of Henry, 'whoso bore his burden of gold and silver, durst no man say to him nought but good.' The maintenance of so effective a system of police must, no doubt, have made a great difference between these reigns and those of Rufus and Stephen,—in both of which robbery ranged the kingdom almost without restraint, and, in the latter especially, the whole land was almost given up as a prey to anarchy, and the power of the *strongest*. But still even this supremacy of the law was in

many respects an oppressive bondage to the subject. In this, as in everything else, the main object of the government was the protection and augmentation of the royal revenue; and it may be correctly enough affirmed, that private robbery and depredation were prohibited and punished chiefly on the principle that no interference was to be tolerated with the rights of the great public robber, the government. Many of the laws, also, which were so sternly enforced, were in reality most unjust and grievous restrictions upon the people. Of this character, in particular, were the forest laws, which punished a trespass upon the royal hunting grounds, or the slaughter of a wild beast, with the same penalty that was inflicted upon the robber or the murderer. And in all cases the vengeance of the law was wreaked upon its victims in a spirit so precipitate, reckless, and merciless, that any salutary effect of the example must have been, to a great extent, neutralised by its tending to harden and brutalise the public mind; and the most cruel injustice must have been often perpetrated in the name, and under the direct authority, of the law.

Henry I. was popularly called the 'Lion of Justice,' and he well deserved the name. His mode of judicial procedure was in the highest degree summary and sweeping. In the twenty-fifth year of his reign, for instance, in a fit of furious indignation occasioned by the continued and increasing debasement of the coin, he had all the moneyers in the kingdom, to the number of more than fifty, brought up before the Court of Exchequer, when, after a short examination by the treasurer, they were all, except four, taken one by one into an adjoining apartment, and punished by having their right hands struck off, and being otherwise mutilated. The year before, he had hanged at one time, at Huncot, in Leicestershire, no fewer than forty-four persons, charged with highway robbery. Robberies, however, of the most atrocious description were, during a great part of the reign, perpetrated, without check, by the immediate servants, and it may be said under the very orders, of the crown. The insolence of the purveyors and numerous followers of the court in the royal progresses is described by contemporary writers as having reached a height under this king far transcending even what it had attained to under either of his immediate predecessors. They used not only to enter the houses of the farmers and peasantry without leave asked, to take up their lodgings and remain as long as it suited them, and to eat and drink their fill of whatever they found, but, in the wantonness of their official licence, frequently even to burn or otherwise destroy what they could not consume. At other times they would carry it away with them, and sell it. If the owners ventured to remonstrate, *their houses* would probably be set on fire about

their ears, or mutilation, and sometimes even death, might punish their presumption. Nor was it their goods only that were plundered or wasted; the honour of their wives and daughters was equally a free prey to these swarms of protected spoilers. The approach of the king to any district, accordingly, spread as much dread as could have been occasioned by an announcement that a public enemy was at hand. The inhabitants were wont to conceal whatever they had, and flee to the woods.

It was not till the necessity of reforming these frightful abuses was at last forced upon Henry, by the solitude which he found around him wherever he appeared,—in other words, till this system of unrestrained rapacity came at last to defeat its own purpose,—that he had some of the delinquents brought before him, and punished by the amputation of a hand or a foot, or the extraction of one of their eyes. Yet the most unsparing pillage of the people in other forms continued throughout the whole of this reign. Taxes were imposed without reference to any other consideration except the wants of the crown; and the raising of the money was managed by any measures, however violent or irregular, that would serve that end. It is an affecting trait of the sufferings of one numerous class of the people, which is recorded by the historian Eadmer, in his statement that the peasantry on the domains of the crown would sometimes offer to give up their ploughs to the king, in their inability to pay the heavy exactions with which they were burdened. These unhappy men, it is to be remembered, were without any means of escape from the extortion which thus ground them to the earth; even if, in some cases, they were not attached to the soil by any legal bond, they might still be considered as rooted to it nearly as much as the trees that grew on it; for in that state of society there was, generally speaking, no resource for the great body of the community except to remain in the sphere in which they were born, and in which their fathers had moved.

The same historian paints in strong colours the miseries occasioned by the oppressiveness of the general taxes.

The collectors, he says, seemed to have no sense either of humanity or justice. It was equally unfortunate for a man to be possessed of money, as to be without it. In the latter case, he was cast into prison, or obliged to flee from the country; or his goods were taken and sold; the very door of his house being sometimes carried away as a punishment for not satisfying the demand made upon him. But, if he had money, it was no better; his wealth was only a provocation to the rapacity of *the government*, which never ceased to harass him by threats of *prosecutions* on unfounded charges, or by some of the other

means of extortion at its command, until it drove him to comply with its most unjust requisitions. The language of the Saxon chronicler is to the same purport, and equally strong. 'God knows,' says that other contemporary writer, 'how unjustly this miserable people is dealt with. First they are deprived of their property, and then they are put to death. If a man possesses anything, it is taken from him; if he has nothing, he is left to perish by famine.'

A legend respecting Henry I., which is related by some of the old historians, forcibly depicts the deep sense that was popularly entertained of the tyranny of his government, and the fierce hatred which it engendered in the hearts of his subjects. In the year 1130, as he was passing over to Normandy, he is said to have been visited one night with an extraordinary dream or vision. First, there gathered around him a multitude of countrymen, bearing scythes, spades, and pitchforks, and with anger and threatening in their countenances; they passed away, and the place they had occupied was filled by a crowd of armed soldiers with drawn swords; the scene changed again, and crosiered bishops seemed to be leaning over his bed, ready to fall upon him, as if they meant to kill him with their holy staves. Thus the tillers of the ground, the military, and the church—the three most important interests of the kingdom—appeared to have each sent its representatives to reproach, and curse, and menace him. The dream is said to have produced a great impression upon Henry. He awoke in extreme perturbation, leaped out of his bed, seized his sword, and called violently for his attendants. When he became more calm, he solemnly resolved upon repentance and amendment of life, and it is affirmed that from this time he began to be an altered man.

DIVISION.

Find the value of—

- | | |
|---|--|
| (1) $\frac{1}{2}$ of a pound sterling. | (2) $\frac{1}{10}$ of a pound sterling. |
| (3) $\frac{1}{4}$ of a guinea. | (3) $\frac{1}{20}$ of a shilling. |
| (5) $\frac{1}{4}$ of a penny. | (6) $\frac{1}{4}$ of a pound sterling. |
| (7) $\frac{1}{8}$ of half-a-crown. | (8) $\frac{1}{10}$ of five shillings. |
| (9) $\frac{1}{11}$ of a florin. | (10) $\frac{1}{12}$ of a cwt. |
| (11) $\frac{1}{12}$ of a cwt. | (12) of a ton. |
| (13) $\frac{1}{4}$ of an acre. | (14) $\frac{1}{17}$ of a mile. |
| (15) $\frac{1}{7}$ of an ell. | (16) of a lb. Troy. |
| (17) $\frac{1}{8}$ of $\frac{5}{8}$ of 13 cwt. | (18) $9\frac{1}{2}$ of $\frac{1}{2}$ of £5. |
| (19) $\frac{1}{2}$ of $\frac{1}{3}$ of $\frac{15}{16}$ of 3 tons. | (20) of $\frac{7}{8}$ of 35 miles. |
| (21) $8\frac{1}{2}$ of $\frac{2}{3}$ of 9 yards. | (22) $8\frac{1}{4}$ of $3\frac{1}{2}$ of 17 lbs. Troy. |

RAIN AND DEW.

(From 'Chemistry of Common Life,' by Professor Johnston.)

ho-ri'-zon, the place where the sky and earth appear to meet
 be-nef'-i-cence, active goodness
 can'-o-py, a covering
 dis'-si-pa-ted, scattered, wasted
 sus-pen'-sion, the act of hanging
 tem'-per-a-ture, state as regards heat or cold
 a'-que-ous, watery
 ad-apt-a'-tion, fitness

min'-is-ter (v.), to serve
 e-vap-o-ra'-tion, the act of passing off in vapour
 ad-just'-ment, the act of putting in order, or fitting one thing to another
 dif-fu'-sed, spread
 pre-cip'-i-ta-ted, thrown down
 su-per-flu'-i-ty, more than enough; excess

WHEN the summer sun has sunk beneath the horizon, and coolness revisits the scorched plant and soil, the grateful dew descends along with it, and moistens alike the green leaf and the thirsty land—the invisible moisture of the air thickens into hazy mists, and settles in tiny pearls on every cool thing. How thankful for this nightly dew has nature everywhere and always appeared! and how have poets in every age sung of its beauty and beneficence!

Let us attend for a moment to the cause of this descent of the dew, and to the way in which it seems to select, as it were, the spots on which it will fall.

All bodies on the surface of the earth radiate, or throw out rays of heat in straight lines—every warmer body to every colder—and the whole earth itself is continually sending rays of heat upwards through the clear air into free cold space. Thus on the earth's surface all bodies strive, as it were, after an equality of temperature (an equilibrium of heat), while the surface, as a whole, tends gradually towards a cooler state. But while the sun shines on any spot this cooling will not take place, for the surface there receives for the time more heat than it gives off; and when the sun goes down, if the clear sky be shut out by a canopy of clouds, these will arrest and again throw back to the earth a portion of the heat which escapes by radiation, and will thus prevent it from being dissipated. At night, then, when the sun is absent, the earth will cool the most—on clear nights also more than when it is cloudy; and when clouds only partially obscure the sky, those parts will become coolest which look towards the clearest portions of the heavens.

Again, the quantity of vapour which the air is capable of holding in suspension is dependent upon its temperature. At high temperatures, in warm climates, or in warm weather, it can sustain more—at low temperatures, or in cold weather, less.

Hence when a current of comparatively warm air, loaded with moisture, ascends to, or comes in contact with, a cold mountain top, it is cooled down—is rendered incapable of holding the

whole of the vapour in suspension, and therefore leaves behind, in the form of a mist or cloud, encapping the lofty summit, a portion of its watery burden. The aqueous particles which float in this mist appear again on the plains below, in the form of streams or springs, which bring nourishment at once, and a grateful relief to the thirsty soil. So, when the surface cools by radiation, the air in contact with it must cool also; and, like the warm currents on the mountain side, must forsake a portion of the watery vapour it has hitherto retained. This water, like the floating mist on the hills, descends in particles almost infinitely minute. These particles collect on every leaflet, and suspend themselves from every blade of grass in drops of 'pearly dew.'

And mark here a beautiful adaptation. Different substances are endowed with the property of radiating their heat, and of thus becoming cool with different degrees of rapidity. Those substances which in the air become cool first, must also attract, first and most abundantly, the particles of falling dew. Thus, in the cool of a summer's evening the grass-plot is wet, while the gravel walk is dry; and the thirsty pasture and every green leaf are drinking in the descending moisture, while the naked land and the barren highway are still unconscious of its fall.

And from the same atmospheric store of watery vapour come the refreshing showers which descend in our temperate zone, and the rushing rains which fall in torrents within the tropical regions; only, the mode in which they are made to descend is different.

In the upper regions of the atmosphere currents of cold air are continually rushing from the north, and currents of warm air from the south. When two such currents of unequal temperature, each loaded with moisture, meet in the atmosphere, they mix, and the mixture has the mean temperature of the two; but air of this mean temperature is incapable of holding in suspension the mean quantity of watery vapour contained in the two currents. Hence, as on the mountain side, a cloud is formed, and the excess of moisture collecting into drops, falls to the earth in the form of rain.

When we consider how small a proportion of watery vapour exists in the air—that were it all to come down at once over the whole earth, it would cover the surface only to a depth of five inches—we cannot think without amazement of the vast and continuous effects it produces. The quantity of rain which falls yearly on our islands would cover them, were it all to fall at once, to a depth of from twenty-five to thirty inches; and, except the table-land of central Spain, there are few places in western Europe where the depth of yearly rain is less than twenty inches. And all this rain descends from an atmosphere

which does not contain more, probably, at any one time, than falls yearly in dew alone over the whole earth.

In descending, also, this rain discharges another office: it washes the air as it passes through it, dissolving and carrying down those accidental vapours which, though unwholesome to man, are yet fitted to assist the growth of plants. It thus ministers in another double manner to our health and comfort, purifying the air we breathe, and feeding the plants on which we live. As soon, again, as the rain ceases to fall, and the clear sky permits the sun's rays once more to warm the surface of the earth, vapours begin to rise anew, and the sweeping winds dry up the rains and dews from its moistened surface. There are regions of the globe, also, where unending summer plays on the surface of the wide seas, and causes a perpetual evaporation to lift up unceasing supplies of water into the air. These supplies the wind wafts to other regions; and thus the water which descends in rain or dew in one spot, is replaced by that which mounts up in vapour from another. And all this to maintain unbroken that nice adjustment which fits the constitution of the atmosphere to the wants of living things!

How beautiful is the arrangement by which water is thus constantly evaporated or distilled, as it were, into the atmosphere—more largely from some, more sparingly from other spots—then diffused equally through the wide and restless air, and afterwards precipitated again in refreshing showers which cleanse the tainted air, or in long mysterious dews. But how much more beautiful the contrivance—I might almost say the instinctive tendency—by which the dew selects the objects on which it delights to fall; descending first on every living plant, copiously ministering to the wants of each, and expending its superfluity only on the unproductive waste!

And equally kind and bountiful, when understood, nature is seen to be in all her operations. Neither skill nor materials are ever wasted; and yet she ungrudgingly dispenses her favours apparently without measure, and has subjected dead matter to laws which compel it to minister, and yet with a most ready willingness, to the wants and comforts of every living thing.

REDUCTION OF VULGAR FRACTIONS.

Reduce	to the fraction of	Reduce	to the fraction of
(1) 8 <i>d.</i>	2 <i>s.</i> 9 <i>d.</i>	(9) 3 qrs. 2 bus.	1 load.
(2) 18 <i>s.</i> 6½ <i>d.</i>	£9 11 <i>s.</i> 6 <i>d.</i>	(10) ¾ of 11 gals.	2 hhds (wine).
(3) £3 2 <i>s.</i> 6 <i>d.</i>	8 guineas.	(11) £1 6 <i>s.</i> 7 <i>d.</i>	£5 17 <i>s.</i> 6½ <i>d.</i>
(4) £5 11 <i>s.</i> 6 <i>d.</i>	£19 11 <i>s.</i> 6 <i>d.</i>	(12) 2½ miles	6 leagues.
(5) 5 dwts. 11 grs.	3 oz.	(13) 4½ of 7 in.	4 ells.
(6) 2 <i>s.</i> 1 <i>d.</i>	7 <i>s.</i> 9 <i>d.</i>	(14) ¾ of an acre	¾ sq. mile.
(7) 3 qrs. 26 lbs.	1 cwt.	(15) ¾ of 36 days	1 yr. 28 days.
(8) 5 cwt.	2 tons 3 cwt.		

(Selections from Spenser, Shakespeare, Ben Jonson, and G. Herbert.)

UNA AND THE LION.

(Edmund Spenser.)

<p>Born, 1553; died, 1599. Principal work, 'The Faëry Queen.' prease (n.), a press, a crowd un-dight, put off weet (v.), to know puis'-sance, power, strength limn (v.), to paint</p>	<p>As-træf'-a, the goddess of Justice con-serve (v.), to preserve without loss frus'-trate, to defeat, to disappoint com-pact'-ed, held together stole (n.), a robe</p>
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YET she, most faithful lady, all this while
 Forsaken, woeful, solitary maid,
 Far from all people's prease, as in exile,
 In wilderness and wasteful deserts strayed,
 To seek her knight, who subtly betrayed
 Through that late vision which th' enchanter wrought,
 Had her abandoned; she of nought afraid
 Through woods and wastenes wide him daily sought,
 Yet wished tidings none of him unto her brought.

One day, nigh weary of the irksome way,
 From her unhasty beast she did alight;
 And on the grass her dainty limbs did lay,
 In secret shadow, far from all men's sight;
 From her fair head her fillet she undight,
 And laid her stole aside; her angel's face
 As the great eye of Heaven shined bright,
 And made a sunshine in the shady place;
 Did never mortal eye behold such heavenly grace.

It fortune'd, out of the thickest wood
 A ramping lion rushèd suddenly,
 Hunting full greedy after savage blood:
 Soon as the royal virgin he did spy,
 With gaping mouth at her ran greedily,
 To have at once devour'd her tender corse:
 But to the prey when as he drew more nigh,
 His bloody rage assuagèd with remorse,
 And, with the sight amazed, forgot his furious force:

Instead thereof he kissed her weary feet,
 And licked her lily hands with fawning tongue;
 As he her wrongèd innocence did meet.
 O how can beauty master the most strong,
 And simple truth subdue avenging wrong!
 Whose yielded pride, and proud submission,
 Still dreading death, when she had markèd long,
 Her heart 'gan melt in great compassion,
 And drizzling tears did shed for pure affection.

'The lion, lord of every beast in field,'
 Quoth she, 'his princely puissance doth abate,
 And mighty proud to humble weak does yield,
 Forgetful of the hungry rage which late,
 Him prick'd, in pity of my sad estate;
 But he, my lion and my noble lord,
 How does he find in cruel heart to hate,
 Her that him loved, and ever most adored,
 As the god of my life? why hath he me abhorred?'

Redounding tears did choke the end of her plaint,
 Which softly echoed from the neighbour wood;
 And, sad to see her sorrowful constraint,
 The kingly beast upon her gazing stood:
 With pity calm'd down fell his angry mood.
 At last, in close heart shutting up her pain,
 Arose the virgin, born of heavenly brood,
 And to her snowy palfrey got again,
 To seek her strayed champion if she might attain.

The lion would not leave her desolate,
 But with her went along, as a strong guard
 Of her chaste person, and a faithful mate
 Of her sad troubles, and misfortunes hard:
 Still, when she slept, he kept both watch and ward;
 And when she waked, he waited diligent,
 With humble service to her will prepared;
 From her fair eye he took commandement,
 And ever by her looks conceivèd her intent.

Faëry Queen.

THE HORSE OF ADONIS.

(Shakespeare.)

Born, 1564; died, 1616. Principal works:—his celebrated Plays and Sonnets.

Look, when a painter would surpass the life,
 In limning out a well-proportioned steed,
 His art with nature's workmanship at strife,
 As if the dead the living should exceed:
 So did this horse excel a common one
 In shape, in courage, colour, pace, and bone.

Round-hoofed, short-jointed, fetlocks shag and long,
 Broad breast, full eye, small head, and nostril wide,
 High crest, short ears, straight legs, and passing strong,
 Thin mane, thick tail, broad buttock, tender hide:
 Look! what a horse should have, he did not lack,
 Save a proud rider on so proud a back.

Sometimes he scuds far off, and there he stares;
 Anon he starts at stirring of a feather.
 To bid the wind a base* he now prepares,
 And wh'er he run, or fly, they know not whether.
 For through his mane and tail the high wind sings,
 Fanning the hairs, who wave like feather'd wings.

Venus and Adonis.

THE VICISSITUDES OF LIFE.

(Wolsey.)

Farewell, a long farewell to all my greatness!
 This is the state of man: to-day he puts forth
 The tender leaves of hopes, to-morrow blossoms,
 And bears his blushing honours thick upon him;
 The third day comes a frost, a killing frost,
 And when he thinks, good easy man, full surely
 His greatness is a-ripening, nips his root,
 And then he falls as I do. I have ventur'd,
 Like little wanton boys, that swim on bladders,
 These many summers, in a sea of glory;
 But far beyond my depth: my high-blown pride
 At length broke under me; and now has left me,
 Weary and old with service, to the mercy
 Of a rude stream, that must for ever hide me.
 Vain pomp and glory of this world, I hate ye!
 I feel my heart new-open'd. Oh, how wretched
 Is that poor man that hangs on prince's favours!
 There is, betwixt that smile he would aspire to,
 That sweet aspect of princes, and their ruin,
 More pangs and fears than wars or women have,
 And, when he falls, he falls like Lucifer,
 Never to hope again.

Henry the Eighth.

* 'To bid the wind a base:' i.e. to challenge the wind, to contend with him in speed; *base*, *prison-base*, or *prison-bars*, was a rustic game consisting chiefly in running.

THE GOLDEN AGE RESTORED.

(Ben Jonson.)

Born, 1574; died, 1637. Principal works, Plays and Court Masques.

Pallas. Look, look! rejoice and wonder
That you, offending mortals, are
(For all your crimes) so much the care
Of him that bears the thunder!

Jove can endure no longer,
Your great ones should your less invade;
Or that your weak, though bad, be made
A prey unto the stronger,

And therefore means to settle
Astræa in her seat again;
And let down in his golden chain
An age of better metal.

Which deed he doth the rather,
That even Envy may behold
Time not enjoyed his head of gold
Alone beneath his father,

But that his care conserveth,
As time, so all time's honours too,
Regarding still what heav'n should do,
And not what earth deserveth.

(A tumult and clashing of arms heard within.)

But hark! what tumult from yon cave is heard?
What noise, what strife, what earthquake and alarms,
As troubled Nature for her Maker fear'd,
And all the Iron Age were up in arms!

Hide me, soft cloud, from their profaner eyes,
Till insolent rebellion take the field;
And as their spirits with their counsels rise,
I frustrate them all with showing but my shield.

(She retires behind a cloud.)

The commencement of the Masque 'The Golden Age Restored.'

VIRTUE.

(George Herbert.)

Born, A.D. 1593; died, A.D. 1633. Principal poem, 'The Temple, or Sacred Poems and Private Ejaculations.'

Sweet day! so cool, so calm, so bright,
The bridal of the earth and sky;
The dews shall weep thy fall to-night;
For thou must die!

Sweet rose! whose hue, angry and brave,
Bids the rash gazer wipe his eye;
Thy root is ever in its grave;
And thou must die!

Sweet spring! full of sweet days and roses,
A box where sweets compacted lie;
Thy music shows ye have your closes,
And all must die!

Only a sweet and virtuous soul,
Like season'd timber never gives;
But, though the whole world turn to coal,
Then chiefly lives.

The Temple.

VULGAR FRACTIONS.

MISCELLANEOUS EXAMPLES.

- (1) $4\frac{5}{9}$ of $17\frac{7}{8} \times (3\frac{2}{10} + 4\frac{5}{8} - 1\frac{2}{11})$.
- (2) $\{(86\frac{1}{11} - \frac{3}{8}$ of $\frac{5}{6}) + (9\frac{1}{10}$ of $\frac{4}{7} \times 1\frac{1}{2})\} \div 15$.
- (3) $\frac{4}{7}$ of $\frac{8}{9} + \frac{5}{13}$ of $1\frac{4}{5}$.
- (4) $5\frac{1}{10}$ of $8\frac{1}{8}$
 $3\frac{1}{11}$ of $4\frac{9}{10}$.
- (5) $8\frac{9}{10} + 5\frac{4}{7} \div 9\frac{7}{8}$ of $2\frac{1}{3}$
 $18\frac{4}{5}$ of $7\frac{5}{11} \div 3\frac{1}{4} - 2\frac{1}{8}$.
- (6) Which is the greater of the following: $\frac{2}{3}$ of 7 or $\frac{5}{8}$ of $6\frac{1}{2}$? and by how much?
- (7) Divide the sum of $8\frac{1}{2}$ and $3\frac{2}{38}$ by the product of $\frac{2}{10}$ and $\frac{1}{12}$; and add to the quotient the following fraction, after reducing it to its simplest form, $\frac{9\frac{1}{10} + 4\frac{1}{8}}{7\frac{1}{2} - 4\frac{1}{16}}$.
- (8) If $56\frac{5}{8}$ yards of cloth cost $\pounds 17\frac{9}{16}$, how many pieces, each containing $27\frac{1}{16}$ yards, can be bought for $\pounds 87\frac{45}{16}$?

RURAL LIFE IN SWEDEN.

(From the Introduction to 'The Children of the Lord's Supper,' by H. W. Longfellow.)

pa'-tri-arch, the father and ruler of a
family
pri-me'-val, as it existed in the earliest
ages
a-non', soon, now and then
heir'-loom, any furniture or chattel which
descends to the heir only
ar-mo'-ri-al bear'-ings, coats of arms
pas'-tor, a shepherd, a clergyman
con, to study, to consider

chan-ti'-cleer', the cock that crows
her'-ald, the officer who publicly announces
an event; a forerunner
hos-pi-tal'-i-ty, kindness to guests
kir'-tle, a gown
o-ra'-tion, a set speech
min-u-et', a stately regular dance
zen'-ith, the point of the heavens imme-
diately over our heads
so-no'-rous, loud sounding

THERE is something patriarchal still lingering about rural life in Sweden, which renders it a fit theme for song. Almost primeval simplicity reigns over that northern land—almost primeval solitude and stillness. You pass out from the gate of the city, and, as if by magic, the scene changes to a wild woodland landscape. Around you are forests of fir. Overhead hang the long fan-like branches trailing with moss, and heavy with red and blue cones. Under foot is a carpet of yellow leaves; and the air is warm and balmy. On a wooden bridge you cross a little silver stream; and anon come forth into a pleasant and sunny land of farms. Wooden fences divide the adjoining fields. Across the road are gates, which are opened by troops of children. The peasants take off their hats as you pass; you sneeze, and they cry, 'God bless you!' The houses in the villages and smaller towns are built of hewn timber, and for the most part painted red. The floors of the taverns are strewn with the fragrant tips of fir-boughs. In many villages there are no taverns, and the peasants take turns in receiving travellers. The thrifty housewife shows you into the best chamber, the walls of which are hung round with rude pictures from the Bible; and brings you her heavy silver spoon—an heirloom—to dip the curdled milk from the pan. You have oaten cakes baked some months before, or bread with anise-seed and coriander in it, or perhaps a little pine-bark. Meanwhile the sturdy husband has brought the horses from the plough, and harnessed them to your carriage. Solitary travellers come and go in uncouth one-horse chaises. Most of them have pipes in their mouths, and hanging around their necks in front a leather wallet, in which they carry tobacco, and the great bank-notes of the country, as large as your two hands. You meet also groups of Dalekarlian peasant-women, travelling homeward or townward in pursuit of work. They walk barefoot, carrying in their hands their shoes, which have *high heels* under the hollow of the foot, and soles of birch-bark.

Frequent too are the village churches, standing by the roadsides, each in its own little Garden of Gethsemane. In the parish register great events are doubtless recorded. Some old king was christened or buried in that church; and a little sexton, with a rusty key, shows you the baptismal font, or the coffin. In the churchyard are a few flowers, and much green grass; and daily the shadow of the church-spire, with its long tapering finger, counts the tombs, representing the dial-plate of human life, on which the hours and minutes are the graves of men. The stones are flat, and large, and low, and perhaps sunken, like the roofs of old houses. On some are armorial bearings; on others only the initials of the poor tenants, with a date, as on the roofs of Dutch cottages. They all sleep with their heads to the westward. Each held a lighted taper in his hand when he died; and in his coffin were placed his little heart-treasures, and a piece of money for his last journey. Babies that came lifeless into the world were carried in the arms of grey-haired old men to the only cradle they ever slept in; and in the shroud of the dead mother were laid the little garments of the child that lived and died in her bosom. And over this scene the village pastor looks from his window in the stillness of midnight, and says in his heart, 'How quietly they rest, all the departed!'

Near the churchyard-gate stands a poor-box, fastened to a post by iron bands, and secured by a padlock, with a sloping wooden roof to keep off the rain. If it be Sunday, the peasants sit on the church-steps and con their psalm-books. Others are coming down the road with their beloved pastor, who talks to them of holy things from beneath his broad-brimmed hat. He speaks of fields and harvests, and of the parable of the sower that went forth to sow. He leads them to the Good Shepherd, and to the pleasant pastures of the spirit-land. He is their patriarch, and, like Melchizedek, both priest and king, though he has no other throne than the church-pulpit. The women carry psalm-books in their hands, wrapped in silk handkerchiefs, and listen devoutly to the good man's words; but the young men, like Gallio, care for none of these things. They are busy counting the plaits in the kirtles of the peasant-girls, their number being an indication of the wearer's wealth. It may end in a wedding.

I will endeavour to describe a village wedding in Sweden. It shall be in summer-time, that there may be flowers, and in a southern province, that the bride may be fair. The early song of the lark and of chancicleer are mingling in the clear morning air, and the sun, the heavenly bridegroom with golden locks, arises in the east, just as our earthly bridegroom with yellow hair arises in the south. In the yard there is a sound

of voices and trampling of hoofs, and horses are led forth and saddled. The steed that has to bear the bridegroom has a bunch of flowers upon his forehead, and a garland of corn-flowers around his neck. Friends from the neighbouring farms come riding in, their blue cloaks streaming to the wind; and, finally, the happy bridegroom, with a whip in his hand, and a monstrous nosegay in the breast of his black jacket, comes forth from his chamber; and then to horse and away towards the village where the bride already sits and waits.

Foremost rides the spokesman, followed by some half-dozen village musicians. Next comes the bridegroom, between his two groomsmen, and then forty or fifty friends and wedding guests, half of them perhaps with pistols and guns in their hands. A kind of baggage-waggon brings up the rear, laden with food and drink for these merry pilgrims. At the entrance of every village stands a triumphal arch, adorned with flowers, and ribands, and evergreens; and as they pass beneath it, the wedding guests fire a salute, and the whole procession stops. And straight from every pocket flies a black-jack, filled with punch or brandy. It is passed from hand to hand among the crowd; provisions are brought from the waggon, and, after eating and drinking and hurraing, the procession moves forward again, and at length draws near the house of the bride. Four heralds ride forward to announce that a knight and his attendants are in the neighbouring forest, and pray for hospitality. 'How many are you?' asks the bride's father. 'At least three hundred,' is the answer: and to this the host replies, 'Yes; were you seven times as many, you should all be welcome; and in token thereof, receive this cup.' Whereupon each herald receives a can of ale; and soon after the whole jovial company comes storming into the father's yard, and, riding round the maypole which stands in the centre, alight amid a grand salute and flourish of music.

In the hall sits the bride, with a crown upon her head and a tear in her eye, like the Virgin Mary in old church-paintings. She is dressed in a red bodice and kirtle, with loose linen sleeves. There is a gilded belt around her waist; and around her neck strings of golden beads, and a golden chain. On the crown rests a wreath of wild roses, and below it another of cypress. Loose over her shoulders falls her flaxen hair; and her blue innocent eyes are fixed upon the ground. O thou good soul! thou hast hard hands, but a soft heart! Thou art poor: the very ornaments thou wearest are not thine; they have been hired for this great day. Yet thou art rich—rich in health, rich in hope, rich in thy first young fervent love. The blessings of Heaven be upon thee! So thinks the parish priest, as *he joins together the hands of bride and bridegroom, saying in*

deep solemn tones, 'I give thee in marriage this damsel, to be thy wedded wife in all honour; and to share thy house, thy lock and key, and every third penny which you two may possess, or may inherit, and all the rights which Upland's laws provide, and the holy King Erik gave.'

The dinner is now served, and the bride sits between the bridegroom and the priest. The spokesman delivers an oration, after the ancient custom of his fathers. He interlards it well with quotations from the Bible, and invites the Saviour to be present at the marriage-feast, as He was at the marriage-feast of Cana of Galilee. The table is not sparingly set forth. Each makes a long arm, and the feast goes cheerily on. Punch and brandy pass round between the courses, and here and there a pipe is smoked, while waiting for the next dish. They sit long at table; but, as all things must have an end, so must a Swedish dinner. Then the dance begins. It is led off by the bride and the priest, who perform a solemn minuet together. Not till after midnight comes the last dance. The girls form a ring around the bride, to keep her from the hands of the married women, who endeavour to break through the magic circle and seize their new sister. After long struggling, they succeed; and the crown is taken from her head, and the jewels from her neck, and her bodice is unlaced, and her kirtle taken off; and like a vestal virgin, clad all in white, she goes,—but it is to her marriage-chamber, not to her grave; and the wedding guests follow her with lighted candles in their hands. And this is a village bridal!

Nor must I forget the suddenly changing seasons of the northern clime. There is no long and lingering spring, unfolding leaf and blossom one by one; no long and lingering autumn, pompous with many-coloured leaves and the glow of Indian summers. But winter and summer are wonderful, and pass into each other. The quail has hardly ceased piping in the corn, when winter, from the folds of trailing clouds, sows broadcast over the land snow, icicles, and rattling hail. The days wane apace. Erelong the sun hardly rises above the horizon, or does not rise at all. The moon and the stars shine through the day; only, at noon, they are pale and wan, and in the southern sky a red, fiery glow, as of sunset, burns along the horizon, and then goes out. And pleasantly under the silver moon, and under the solemn silent stars, ring the steel shoes of the skaters on the frozen sea, and voices, and the sound of bells.

And now the northern lights begin to burn, faintly at first, like sunbeams playing in the waters of the blue sea. Then a soft crimson glow tinges the heavens. There is a blush on the cheek of night. The colours come and go, and change from crimson to gold, from gold to crimson. The snow is stained

with rosy light. Twofold from the zenith, east and west, flames a fiery sword; and a broad band passes athwart the heavens like a summer sunset. Soft purple clouds come sailing over the sky, and through their vapoury folds the winking stars shine white as silver. With such pomp as this is merry Christmas ushered in, though only a single star heralded the first Christmas. And in memory of that day the Swedish peasants dance on straw, and the peasant-girls throw straws at the timbered roof of the hall, and for every one that sticks in a crack shall a groomsman come to their wedding. Merry Christmas indeed! For pious souls there shall be church-songs and sermons, but for Swedish peasants brandy and nut-brown ale in wooden bowls; and the great Yulecake crowned with a cheese, and garlanded with apples, and upholding a three-armed candlestick over the Christmas feast.

And now the glad leafy midsummer, full of blossoms and the song of nightingales, is come! St. John has taken the flowers and festival of heathen Balder; and in every village there is a maypole fifty feet high, with wreaths and roses, and ribands streaming in the wind, and a noisy weathercock on top, to tell the village whence the wind cometh and whither it goeth. The sun does not set till ten o'clock at night, and the children are at play in the streets an hour later. The windows and doors are all open, and you may sit and read till midnight without a candle. Oh, how beautiful is the summer night, which is not night, but a sunless yet unclouded day, descending upon earth with dews and shadows and refreshing coolness! How beautiful the long mild twilight, which, like a silver clasp, unites to-day with yesterday! How beautiful the silent hour, when morning and evening thus sit together, hand in hand, beneath the starless sky of midnight! From the church-tower in the public square the bell tolls the hour, with a soft musical chime; and the watchman, whose watchtower is the belfry, blows a blast on his horn for each stroke of the hammer; and four times, to the four corners of the heavens, in a sonorous voice he chants,—

Ho! watchman, ho!
Twelve is the clock!
God keep our town
From fire and brand
And hostile hand!
Twelve is the clock!

From his swallow's-nest in the belfry he can see the sun all night long; and farther north the priest stands at his door in the warm midnight, and lights his pipe with a common burning-glass.

VULGAR FRACTIONS.

MISCELLANEOUS EXAMPLES.

- (1) If $\frac{7}{18}$ of 3 tons of coals cost £2 $\frac{11}{18}$, what will be the cost of $\frac{5}{8}$ of $\frac{9}{10}$ of 25 $\frac{1}{2}$ tons?
- (2) If 5 $\frac{7}{8}$ yards cost £1 16s. 11 $\frac{1}{2}$ d., how much may be bought for £36 19s. 11 $\frac{1}{2}$ d.?
- (3) Simplify $\frac{\frac{4}{5} \text{ of } \frac{5}{7} \text{ of } \frac{49}{8}}{\frac{1}{8} \text{ of } \frac{3}{5} \text{ of } \frac{5}{6}}$, and take the result from the sum of 4 $\frac{1}{2}$, 3 $\frac{7}{10}$, 9 $\frac{11}{18}$.
- (4) Divide 4 $\frac{1}{5}$ by 1 $\frac{2}{3}$; add to the quotient $\frac{1}{3} + \frac{1}{5} + \frac{1}{6}$; subtract from this sum 2 $\frac{3}{4}$; multiply the remainder by 3 $\frac{1}{2}$ of 4 $\frac{1}{4}$, and find what fraction the product is of 78.
- (5) If $\frac{2}{3}$ of $\frac{3}{5}$ of the value of a ship be £17,864, what would a person's interest be worth whose share was equal to $\frac{5}{6}$ of $\frac{10}{11}$ of the whole?
- (6) Find the cost of 23 acres 3 roods 14 perches, at £7 16s. 7d. per acre.

MAGNA CHARTA, 1215.

(From 'History of England,' by David Hume.)

con'-fer-ence, a meeting for discussion
 congé-d'élire (Fr.), the king's permission
 to a dean and chapter to choose a
 bishop
 su-per-sede', to do away with, to set
 aside
 a-bate'-ment, a lessening
 am-big'-u-ous, of doubtful meaning
 ten'-ure, the right of holding land, &c.
 soc'-age, a tenure of lands by service in
 husbandry
 scu'-tage, a tax levied upon those who
 held lands by knight-service

prel'-ates, bishops and archbishops
 in-ca-pa'-ci-tate, to render unfit, or un-
 able to do a thing
 ar'-bi-tra-ry, without giving a reason
 in-test'-ate, having made no will
 in-a'-li-en-a-ble, that cannot be taken
 away from anyone
 con-cise', expressed by few words
 chi-ca'-ner-y, unfairness, trickery
 com-mo'-tion, a disturbance
 plen'-i-tude, fulness
 pri'-mate, an archbishop
 con-ven'-tion, an agreement, a treaty

[The barons of England, as a measure of self-defence, compelled King John to sign Magna Charta, the foundation of all our liberties, June 1215. He, however, violated it shortly after.]

A CONFERENCE between the king and the barons was appointed at Runnymede, between Windsor and Staines (June 15), a place which has ever since been extremely celebrated on account of this great event. The two parties encamped apart, like open enemies; and after a debate of a few days, the king, with a facility somewhat suspicious (June 19), signed and sealed the charter which was required of him. This famous deed, commonly called the Great Charter, either granted or secured very important liberties and privileges to every order of men in the kingdom—to the clergy, to the barons, and to the people.

The freedom of elections was secured to the clergy; the former charter of the king was confirmed, by which the necessity of a royal congé-d'élire and confirmation was superseded;

all check on appeals to Rome was removed, by the allowance granted every man to depart the kingdom at pleasure; and the fines to be imposed on the clergy for any offence, were ordained to be proportional to their lay estates, not to their ecclesiastical benefices.

The privileges granted to the barons were either abatements in the rigour of the feudal law, or determinations in points which had been left by that law, or had become by practice arbitrary or ambiguous. The reliefs of heirs succeeding to a military fee were ascertained—an earl's and baron's at one hundred marks, a knight's at one hundred shillings. It was ordained by the charter that if the heir be a minor he shall, immediately on his majority, enter on his estate without paying any relief. The king shall not sell his wardship; he shall levy only reasonable profits on the estate, without committing waste or hurting the property; he shall uphold the castles, houses, mills, parks, and ponds; and if he commit the guardianship of the estate to the sheriff or any other, he shall previously oblige them to find surety to the same purpose. During the minority of a baron, while his lands are in wardship and are not in his own possession, no debt which he owes to the Jews shall bear any interest. Heirs shall be married without disparagement; and before the marriage be contracted, the nearest relations of the person shall be informed of it. A widow, without paying any relief, shall enter on her dower—the third part of her husband's rents. She shall not be compelled to marry so long as she chooses to continue single; she shall only give security never to marry without her lord's consent. The king shall not claim the wardship of any minor who holds lands by military tenure of a baron, on pretence that he also holds lands of the crown, by soccage or any other tenure. Scutages shall be estimated at the same rate as in the time of Henry I.; and no scutage or aid, except in the three general feudal cases—the king's captivity, the knighting of his eldest son, and the marrying of his eldest daughter—shall be imposed but by the great council of the kingdom; the prelates, earls, and great barons shall be called to this great council, each by a particular writ; the lesser barons by a general summons of the sheriff. The king shall not seize any baron's land for a debt to the crown, if the baron possesses as many goods and chattels as are sufficient to discharge the debt. No man shall be obliged to perform more service for his fee than he is bound to by his tenure. No governor or constable of a castle shall oblige any knight to give money for castle-guard, if the knight be willing to perform the service in person, or by another able-bodied man; and if the knight be in the field himself by the king's command, he shall be exempted from all other service of this

nature. No vassal shall be allowed to sell so much of his land as to incapacitate himself from performing his service to his lord.

These were the principal articles, calculated for the interest of the barons; and had the charter contained nothing further, national happiness and liberty had been very little promoted by it; as it would only have tended to increase the power and independence of an order of men who were already too powerful, and whose yoke might have become more heavy on the people than even that of an absolute monarch. But the barons, who alone drew and imposed on the prince this memorable charter, were necessitated to insert in it other clauses of a more extensive and more beneficent nature. They could not expect the concurrence of the people without comprehending, together with their own, the interests of inferior ranks of men; and all provisions which the barons for their own sake were obliged to make, in order to insure the free and equitable administration of justice, tended directly to the benefit of the whole community. The following were the principal clauses of this nature:—

It was ordained that all the privileges and immunities above mentioned, granted to the barons against the king, should be extended by the barons to their inferior vassals. The king bound himself not to grant any writ empowering a baron to levy aid from his vassals except in the three feudal cases. One weight and one measure shall be established throughout the kingdom. Merchants shall be allowed to transact all business without being exposed to any arbitrary tolls or impositions; they and all freemen shall be allowed to go out of the kingdom and return to it at pleasure. London, and all cities and boroughs, shall preserve their ancient liberties, immunities, and free customs; aids shall not be required of them but by the consent of the great council; no towns or individuals shall be obliged to make or support bridges but by ancient custom; the goods of every freeman shall be disposed of according to his will; if he die intestate, his heirs shall succeed to them. No officer of the crown shall take any horses, carts, or wood, without the consent of the owner. The king's courts of justice shall be stationary, and shall no longer follow his person; they shall be open to everyone, and justice shall no longer be sold, refused, or delayed by them. Circuits shall be regularly held every year; the inferior tribunals of justice, the county court, sheriff's turn, and court-leet shall meet at their appointed time and place; the sheriff shall be incapacitated to hold pleas of the crown, and shall not put any person on his trial for rumour or suspicion alone, but on the evidence of lawful witnesses. No freeman shall be taken or imprisoned, or dispossessed of his

free tenement and liberties, or outlawed, or banished, or anywise hurt or injured, unless by the legal judgment of his peers, or by the law of the land; and all who suffered otherwise, in this or the two former reigns, shall be restored to their rights and possessions. Every freeman shall be fined in proportion to his fault; and no fine shall be levied on him to his utter ruin; even a villein or rustic shall not by any fine be bereaved of his carts, ploughs, and implements of husbandry. This was the only article calculated for the interests of this body of men, probably at that time the most numerous in the kingdom.

It must be confessed that the former articles of the Great Charter contain such mitigations and explanations of the feudal law as are reasonable and equitable; and that the latter involve all the chief outlines of a legal government, and provide for the equal distribution of justice and free enjoyment of property—the great objects for which political society was at first founded by men, which the people have a perpetual and inalienable right to recall, and which no time, nor precedent, nor statute, nor positive institution ought to deter them from keeping ever uppermost in their thoughts and attention. Though the provisions made by this charter might, conformably to the genius of the age, be esteemed too concise and too bare of circumstances to maintain the execution of its articles in opposition to the chicanery of lawyers, supported by the violence of power, time gradually ascertained the sense of all the ambiguous expressions; and those generous barons who first extorted this concession, still held their swords in their hands, and could turn them against those who dared, on any pretence, to depart from the original spirit and meaning of the grant. We may now, from the tenor of this charter, conjecture what those laws were of King Edward, which the English nation, during so many generations, still desired, with such an obstinate perseverance, to have recalled and established. They were chiefly these latter articles of Magna Charta; and the barons who, at the beginning of these commotions, demanded the revival of the Saxon laws, undoubtedly thought that they had sufficiently satisfied the people by procuring them this concession, which comprehended the principal objects to which they had so long aspired. But what we are most to admire is, the prudence and moderation of those haughty nobles themselves, who were enraged by injuries, inflamed by opposition, and elated by a total victory over their sovereign. They were content, even in this plenitude of power, to depart from some articles of Henry I.'s charter, which they made the foundation of their demands, particularly from the abolition of wardships, a matter of the greatest importance; and they seem to have been sufficiently careful not to diminish too far the power and revenue of the crown. If

they appear, therefore, to have carried other demands to too great a height, it can be ascribed only to the faithless and tyrannical character of the king himself, of which they had long had experience; and which, they foresaw, would, if they provided no further security, lead him soon to infringe their new liberties, and revoke his own concessions. This alone gave birth to those other articles, seemingly exorbitant, which were added as a rampart for the safeguard of the Great Charter.

The barons obliged the king to agree that London should remain in their hands, and the Tower be consigned to the custody of the primate, till the 15th of August ensuing, or till the execution of the several articles of the Great Charter. The better to ensure the same end, he allowed them to choose five-and-twenty members from their own body as conservators of the public liberties, and no bounds were set to the authority of these men either in extent or duration. If any complaint were made of the violation of the charter, whether attempted by the king, justiciaries, sheriffs, or foresters, any four of these barons might admonish the king to redress the grievance; if satisfaction were not obtained, they could assemble the whole council of twenty-five, who, in conjunction with the great council, were empowered to compel him to observe the charter; and in case of resistance might levy war against him, attack his castles, and employ every kind of violence, except against his royal person and that of his queen and children. All men throughout the kingdom were bound, under the penalty of confiscation, to swear obedience to the twenty-five barons; and the freeholders of each county were to choose twelve knights, who were to make report of such evil customs as required redress, conformably to the tenor of the Great Charter. These men were, by this convention, really invested with the sovereignty of the kingdom; they were rendered co-ordinate with the king, or rather superior to him, in the exercise of the executive power: and as there was no circumstance of government which, either directly or indirectly, might not bear a relation to the security or obedience of the Great Charter, there could scarcely occur any incident in which they might not lawfully interpose their authority.

DECIMAL FRACTIONS.

Express as decimal fractions—

- (1) $\frac{1}{5}$; $\frac{1}{2}$; $\frac{1}{4}$. (2) $\frac{1}{25}$; $\frac{1}{10}$; $\frac{1}{40}$. (3) $3\frac{5}{8}$; $5\frac{1}{2}$; $3\frac{13}{20}$ of $4\frac{1}{20}$.

Express as vulgar fractions—

- (4) $\cdot 1$; $\cdot 5$; $\cdot 2$. (5) $\cdot 25$; $\cdot 75$; $\cdot 12$.
 (6) $\cdot 875$; $\cdot 978$; $4\cdot 785$. (7) $\cdot 56$; $\cdot 456$; $731\cdot 96$.
 (8) $4\cdot 9685$; $968\cdot 46732$. (9) $83\cdot 84658$; $26\cdot 16768$.

IRON AND CIVILISATION.

(From 'Industrial Biography,' by S. Smiles.)

con-sum'-mate, complete, finished
 me-di-æ'-val, relating to the middle ages,
 i.e. from the eighth to the fifteenth
 century
 and'-i-rons, the irons fixed to the ends of
 a fire-grate in which the spit turns
 re-tain'-er, an adherent or dependent
 ma-raud'-ing, plundering
 feud, a quarrel
 de-lin'-quen-cy, a fault
 un-wield'-y, clumsy to handle
 smelt'-ing, the operation of separating a
 metal from its ore

Cro'-sus, a king of Lydia, noted for his
 riches, conquered by Cyrus B.C. 548
 al'-chem-ist, a professor of the art of
 transmuting metals
 Hom'-il-don, in Northumberland. The
 English, under Henry Hotspur, defeated
 the Scots under Douglas in 1402
 Crecy, in France. Edward III. and the
 Black Prince here defeated the French
 in 1346
 Agincourt, in France. Henry V. de-
 feated French, 1415

THE smith's tools were of many sorts; but the chief were his hammer, pincers, chisel, tongs, and anvil. It is astonishing what a variety of articles he turned out of his smithy by the help of these rude implements. In the tooling, chasing, and consummate knowledge of the capabilities of iron, he greatly surpassed the modern workman; for the mediæval blacksmith was an artist as well as a workman. The numerous exquisite specimens of his handicraft which exist in our old gateways, church-doors, altar-railings, and ornamented dogs and andirons, still serve as types for continual reproduction. He was, indeed, the most 'cunning workman' of his time. But, besides all this, he was an engineer. If a road had to be made, or a stream embanked, or a trench dug, he was invariably called upon to provide the tools, and often to direct the work. He was also the military engineer of his day, and as late as the reign of Edward III. we find the king repeatedly sending for smiths from the Forest of Dean to act as engineers for the royal army at the siege of Berwick.

The smith being thus the earliest and most important of mechanics, it will readily be understood how, at the time when surnames were adopted, his name should have been so common in all European countries.

Hence the multitudinous family of Smiths in England, in some cases vainly disguised under the 'Smythe' or 'De Smijthe'; in Germany the Schmidts; in Italy the Fabri, Fabricii, or Fabbri; in France the Le Febres or Lefevres; in Scotland the Gows, Gowans, or Cowans. We have also among us the Brownsmiths, or makers of brown bills; the Nasmyths, or nailsmiths; the Arrowsmiths, or makers of arrowheads; the Spearsmiths, or spear-makers; the Shoosmiths, or horse-shoers; the Goldsmiths, or workers of gold; and many more. The smith proper was, however, the worker in iron—the maker of iron tools, implements,

and arms; and hence this name exceeds in number that of all the others combined.

In course of time the smiths of particular districts began to distinguish themselves for their excellence in particular branches of ironwork. From being merely the retainer of some lordly or religious establishment, the smith worked to supply the general demand, and gradually became a manufacturer. Thus the maker of swords, tools, bits, and nails congregated at Birmingham, and the makers of knives and arrowheads at Sheffield. Chaucer speaks of the Miller of Trompington as provided with Sheffield whittle:—

A Sheffield thytel bare he in his hose.

The common English arrowheads manufactured at Sheffield were long celebrated for their excellent temper, as Sheffield iron and steel plates are now. The Battle of Homildon, fought in Scotiand in 1402, was won mainly through their excellence. The historian records that they penetrated the armour of the Earl of Douglas, which had been three years in making, and they were 'so sharp and strong that no armour could repel them.' The same arrowheads were found equally efficient against French armour on the fields of Crecy and Agincourt.

Although Scotland is now one of the principal sources from which our supplies of iron are drawn, it was in ancient times greatly distressed for want of the metal. The people were as yet too little skilled to be able to turn their great mineral wealth to account. Even in the time of Wallace, they had scarcely emerged from the stone period, and were under the necessity of resisting their iron-armed English adversaries by means of rude weapons of that material. To supply themselves with swords and spearheads, they imported steel from Flanders, and the rest they obtained by marauding excursions into England. The district of Furness in Lancashire,—then, as now, an iron-producing district, was frequently ravaged with that object; and on such occasions the Scotch seized and carried off all the manufactured iron they could find, preferring it, though so heavy, to every other kind of plunder. About the same period, however, iron must have been regarded as almost a precious metal even in England itself; for we find that in Edward the Third's reign the pots, spits, and frying-pans of the royal kitchen were classed among his majesty's jewels.

The same famine of iron prevailed to a still greater extent in the Highlands, where it was even more valued, as the clans lived chiefly by hunting, and were in an almost constant state of feud. Hence the smith was a man of indispensable importance among the *Highlanders*, and the possession of a skillful

armourer was greatly valued by the chiefs. The story is told of some delinquency having been committed by a Highland smith, on whom justice must be done; but as the chief could not dispense with the smith, he generously offered to hang two weavers in his stead!

At length a great armourer arose in the Highlands, who was able to forge armour that would resist the best Sheffield arrow-heads, and to make swords that would vie with the best weapons of Toledo and Milan. This was the famous Andrea de Ferrara, whose swords still maintain their ancient reputation. This workman is supposed to have learnt his art in the Italian city after which he was called, and returned to practise it in secrecy among the Highland hills. Before him, no man in Great Britain is said to have known how to temper a sword in such a way as to bend so that the point should touch the hilt and spring back uninjured. The swords of Andrea de Ferrara did this, and were accordingly in great request; for it was of every importance to the warrior that his weapon should be strong and sharp without being unwieldy, and that it should not be liable to snap in the act of combat. This celebrated smith, whose personal identity has become merged in the Andrea de Ferrara swords of his manufacture, pursued his craft in the Highlands, where he employed a number of skilled workmen in forging weapons, devoting his own time principally to giving them their required temper. He is said to have worked in a dark cellar, the better to enable him to perceive the effects of the heat upon the metal, and to watch the nicety of the operation of tempering, as well as possibly to serve as a screen to his secret method of working. . . .

England herself has on more than one occasion been supposed to be in serious peril because of the decay of her iron manufactures. Before the Spanish Armada, the production of iron had been greatly discouraged, because of the destruction of timber in the smelting of the ore—the art of reducing it with pit-coal not having yet been invented; and we were consequently mainly dependent upon foreign countries for our supplies of the material out of which arms were made. The best iron came from Spain itself, then the most powerful nation in Europe, and as celebrated for the excellence of its weapons as for the discipline and valour of its troops. The Spaniards prided themselves upon the superiority of their iron, and regarded its scarcity in England as an important element in their calculations of the conquest of the country by their famous Armada. ‘I have heard,’ says Harrison, ‘that when one of the greatest peers of Spain espied our nakedness in this behalf, and did solemnly utter, in no obscure place, that it would be an easy matter in *a short time* to conquer England because it wanted armour, his

words were not so rashly uttered as politely noted.' The vigour of Queen Elizabeth promptly supplied a remedy by the large importations of iron which she caused to be made, principally from Sweden, as well as by the increased activity of the forges in Sussex and the Forest of Dean; 'whereby,' adds Harrison, 'England obtained rest, that otherwise might have been sure of sharp and cruel wars. Thus a Spanish word, uttered by one man at one time, overthrew, or at the leastwise hindered, sundry privy practices of many at another.'

Nor has the subject which occupied the earnest attention of politicians in Queen Elizabeth's time ceased to be of interest; for, after the lapse of nearly three hundred years, we find the smith and the iron-manufacturer still uppermost in public discussions. It has of late years been felt that our much-prized 'hearts of oak' are no more able to stand against the prows of mail which were supposed to threaten them, than the sticks and stones of the ancient tribes were able to resist the men armed with weapons of bronze or steel. What Solon said to Croesus, when the latter was displaying his great treasures of gold, still holds true:—'If another comes that hath better iron than you, he will be master of all that gold.' So, when an alchemist waited upon the Duke of Brunswick during the Seven Years' War, and offered to communicate the secret of converting iron into gold, the Duke replied:—'By no means; I want all the iron I can find to resist my enemies; as for gold, I get it from England.' Thus the strength and wealth of nations depend upon coal and iron, not forgetting men, far more than upon gold.

DECIMAL FRACTIONS—ADDITION AND SUBTRACTION.

Add together—

(1) 81·456,	7·8103,	646·81678,	307·916703.	
(2) 867·81,	67·89604,	8765·864321.		
(3) 941·36,	68·786,	909·618,	468·293,	46·11.
(4) 76·84,	909·6753,	210·82,	11·909.	
(5) 808·41,	96·808,	61·8493,	128·606,	51·19.
(6) 27·17,	861·1564,	86·72,	82·414.	

Find the difference between—

- (7) 81·46 and 32·568; 78·108 and 62·013.
- (8) 869·0008 and 948·4689.
- (9) 96·001 and 27·606; 63·189 and 96·834.
- (10) 74·1009 and 486·367.

A CHINESE LETTER.

(From 'The Citizen of the World, or Chinese Letters,' by Oliver Goldsmith.)

in-sig-nif-i-cant, unimportant
 prod'-i-gy, anything astonishing
 es'-say, an attempt
 in-vol'-un-ta-ry, not done willingly
 cat'-a-comb, a cave for the burial of the
 dead
 ab-lu'-tion, a washing
 prim'-i-tive, as it was at first
 in'-di-gence, poverty
 lu'sus na-tu'-ræ (Lat.), a freak of na-
 ture

pet'-ri-fy, to change into stone
 re-fute', to prove that something is false
 e-lab'-o-rate, finished with much labour
 so-lit'-ous, very eager
 a-ir'-al, airy
 in-es-ti-ma-ble, too valuable to have a
 price fixed to it
 e-mol'-u-ment, pay, reward
 vag'-a-bond, one who has no settled home
 in-tre-pid'-i-ty, fearlessness

[Oliver Goldsmith, an eminent miscellaneous writer, was born in Ireland in 1728; died in London, 1774. Chief works—Prose: 'State of Polite Learning in Europe,' 'Chinese Letters,' 'Vicar of Wakefield.' Poems: 'The Traveller,' and 'The Deserted Village.' Comedies: 'The Good-natured Man,' and 'She Stoops to Conquer.']

FROM Lien Chi Altangi, to Fum Hoam, First President of the Ceremonial Academy at Peking, in China:—

Though the frequent invitations I receive from men of distinction here might excite the vanity of some, I am quite mortified, however, when I consider the motives that inspire their civility. I am sent for not to be treated as a friend, but to satisfy curiosity; not to be entertained so much as wondered at; the same earnestness which excites them to see a Chinese, would have made them equally proud of a visit from the rhinoceros. From the highest to the lowest, this people seem fond of sights and monsters. I am told of a person here who gets a very comfortable livelihood by making wonders, and then selling or showing them to the people for money: no matter how insignificant they were in the beginning, by locking them up close, and showing them for money, they soon become prodigies! His first essay in this way was to exhibit himself as a waxwork figure behind a glass door at a puppet show. Thus, keeping the spectators at a proper distance, and having his head adorned with a copper crown, he looked extremely natural, and very like the life itself. He continued this exhibition with success, till an involuntary fit of sneezing brought him to life before all the spectators, and consequently rendered him for that time as entirely useless as the peaceable inhabitant of a catacomb. Determined to act the statue no more, he next levied contributions under the figure of an Indian king; and by painting his face, and counterfeiting the savage howl, he frightened several ladies and children with amazing success: in this manner therefore he might have lived very comfortably, had he not been arrested for a debt that was contracted when he was the figure in waxwork. Thus his face underwent an

involuntary ablution, and he found himself reduced to his primitive complexion and indigence.

After some time, being freed from jail, he was now grown wiser, and instead of making himself a wonder, was resolved only to make wonders. He learned the art of pasting up of mummies; was never at the loss for an artificial *lusus naturæ*; nay, it has been reported, that he has sold seven petrified lobsters of his own manufacture to a noted collector of rarities; but this the learned Cracovius Putridus had undertaken to refute in a very elaborate dissertation.

His last wonder was nothing more than a halter, yet by this halter he gained more than by all his former exhibitions. The people, it seems, had got in their heads, that a certain noble criminal was to be hanged with a silken rope.* Now, there was nothing they so much wished to see as this very rope; and he was resolved to gratify their curiosity: he therefore got one made, not only of silk, but, to render it more striking, several threads of gold were intermixed. The people paid their money only to see silk, but were highly satisfied when they found it was mixed with gold into the bargain. It is scarcely necessary to mention, that the projector sold his silken rope for almost what it had cost him, as soon as the criminal was known to be hanged in hempen materials.

By their fondness of sights, one would be apt to imagine, that instead of desiring to see things as they should be, they are rather solicitous of seeing them as they ought not to be. A cat with four legs is disregarded, though never so useful; but if it has but two, and is consequently incapable of catching mice, it is reckoned inestimable, and every man of taste is ready to raise the auction. A man, though in his person faultless as an aerial genius, might starve; but if stuck over with hideous warts, like a porcupine, his fortune is made for ever. . . . A good woman in my neighbourhood, who was bred a habit maker, though she handled her needle tolerably well, could scarcely get employment. But being obliged by an accident, to have both her hands cut off from the elbows, what would in another country have been her ruin, made her fortune here: she was now thought more fit for her trade than before; business flowed in apace, and all people paid for seeing the mantua maker who wrought without hands.

A gentleman, showing me his collection of pictures, stopped at one with peculiar admiration:—‘There,’ cries he, ‘is an inestimable piece.’ I gazed at the picture for some time, but could see none of those graces with which he seemed enrapt-

* It is said that Lord Ferrers, the criminal here meant, actually petitioned that he might be hanged with a silken rope; but his request was not complied with.

tured ; it appeared to me the most paltry piece of the whole collection. I therefore demanded where those beauties lay, of which I was yet insensible. 'Sir,' cries he, 'the merit does not consist in the piece, but in the manner in which it was done. The painter drew the whole with his foot, and held the pencil between his toes. I bought it with a very great price ; for peculiar merit should ever be rewarded.'

But these people are not more fond of wonders than liberal in rewarding those who show them. From the wonderful dog of knowledge, at present under the patronage of the nobility, down to the man with the box, who professes to show 'the best imitation of Nature that was ever seen,' they all live in luxury. A singing woman shall collect subscriptions in her own coach and six ; a fellow shall make a fortune by tossing a straw from his toe to his nose ; one in particular has found that eating fire was the most ready way to live ; and another, who jingles several bells fixed to his cap, is the only man that I know of, who has received emolument from the labours of his head.

A young author, a man of good nature and learning, was complaining to me some nights ago of this misplaced generosity of the times. 'Here,' says he, 'have I spent part of my youth in attempting to instruct and amuse my fellow-creatures, and all my reward has been solitude, poverty, and reproach ; while a fellow, possessed of even the smallest share of fiddling merit, or who has perhaps learned to whistle double, is rewarded, applauded, and caressed !' 'Prithee, young man,' says I to him, 'are you ignorant that, in so large a city as this, it is better to be an amusing than a useful member of society ? Can you leap up, and touch your feet four times before you come to the ground ?'—'No, sir.' 'Can you stand on two horses at full speed ?'—'No, sir.' 'Can you swallow a penknife ?'—'No, sir, I can do none of these tricks.' 'Why then, cried I, 'there is no other prudent means of subsistence left, but to apprise the town that you speedily intend to eat up your own nose, by subscription.'

I have frequently regretted that none of our Eastern posture masters, or showmen, have ever ventured to England ; I should be pleased to see that money circulate in Asia, which is now sent to Italy and France, in order to bring their vagabonds hither. Several of our tricks would undoubtedly give the English high satisfaction. Men of fashion would be greatly pleased with the postures as well as the condescension of our dancing girls ; and the ladies would equally admire the conductors of our fireworks. What an agreeable surprise would it be to see a huge fellow with whiskers flash a charged blunderbuss full in a lady's face without singeing her hair, or *melting* her pomatum. Perhaps, when the first surprise was

over, she might then grow familiar with danger; and the ladies might vie with each other in standing fire with intrepidity.

DECIMAL FRACTIONS—MULTIPLICATION AND DIVISION.

- (1) $4\cdot7 \times 3\cdot8$; $\cdot86 \times \cdot79$; $64\cdot301 \times 22\cdot001$; $\cdot367 \times \cdot486$; $\cdot17 \times \cdot16$.
 (2) $71\cdot5642 \times \cdot0046$; $\cdot0083406 \times 8\cdot066$; $684\cdot406 \times \cdot806$; $\cdot01 \times \cdot01$.
 (3) $1\cdot3214 \div 4\cdot56$; $\cdot0304 \div 64$; $1942 \div \cdot14$; $\cdot2 \div 256$; $26\cdot88 \div \cdot75$.
 (4) $2508 \div \cdot01824$; $1148\cdot112 \div 2\cdot04$; $\cdot1984 \div 62$; $10\cdot966 \div 200$.

COLOUR AND LUMINOSITY OF THE OCEAN.

(From the 'World of Waters,' by Madame Zornlin.)

ex-tra'-ne-ous, proceeding from without
 e-van-es-cent, quickly passing away
 col-late', to collect and arrange
 ul-tra-ma-rine', a fine blue colour obtained from a stone called Lapis Lazuli
 o-pa-ci-ty, the property which bodies that cannot be seen through are said to possess
 mol-lus'-ca, boneless fishes
 lu-min-os-i-ty, a shining appearance
 phe-nom'e-non (pl. phenomena), something out of the ordinary course of nature

spon-ta-ne-ous, voluntary
 lu-cif'-ic, producing light
 pu-tre-fac'-tion, decay
 crus-ta'-ce-a, shell fish
 acin-till-la'-tion, the act of sparkling
 am'e-thyst, a precious stone of a violet colour
 lat'i-tude, distance north or south of the Equator
 gen-er'-a (Lat.), plural of genus; a subdivision of a class in natural history
 spher'-i-cal, round
 an-i-mal'-cules, very minute insects

SEA-WATER appears to be very transparent when undisturbed by extraneous causes. In general, it is more transparent as we recede from the shore, and also in cold climates than in hot. To this there are, however, some exceptions; for the water immediately off the Virgin Islands, in the Caribbean sea, is so remarkably clear, that at the depth of eight or nine fathoms, the floor of the ocean is quite discernible, and the sea-sponge may be distinctly seen in its natural bed.

The changing colours of the sea are familiar to all who have visited the shores of the mighty deep:—

In colour changing, when from clouds or sun
 Shades after shades upon the surface run;
 Embrowned and fearful now; and now serene,
 In limpid blue, or evanescent green.

These almost perpetually varying hues displayed at the surface of the ocean, owe their existence in great measure to the mere reflection of the changing skies in the water. Thus, for instance, an apparently dark inky-coloured sea is usually indicative of an approaching storm; not, however, because the water is really blacker than usual, but because it reflects the general hue of the atmosphere near the horizon. In some cases,

however, these hues are attributable to local causes; for the greenish tint which usually occurs in shallow water, appears to be owing to the yellowish sand in the bed of the ocean, which, mingling its hues with the blue tints of the latter, imparts this hue to the whole mass. But what, then, it may be asked, is the real colour of the ocean? The various particulars connected with this subject, which have been collated by M. Arago, will form the best reply to this inquiry. 'Mr. Scoresby,' he observes, 'compares the general tint of the Polar seas to the blue of *ultramarine*. M. Cortez considers the waters of the Mediterranean to resemble a perfectly clear solution of the finest *indigo*; he also describes them as of a *bright sky-blue*. Captain Tuckey characterises the waters of the Atlantic Ocean by the term *bright azure*. It would, therefore, appear that the colour of the ocean when its waters are unmixed with foreign matter may be considered as sky-blue, of greater or less intensity, according to the proportions of reflected light.' The ocean, however, does not present this sky-blue colour in all localities, this tint being sometimes modified, or even totally changed, in situations where the water has little depth; this variation being dependent on the nature of the bed of the sea. Thus, as has just been observed, a bed of yellow-coloured sand imparts to the sea a greenish tint, because the combination of yellow and blue forms that colour; and the brilliancy of the green will of course depend on the brightness of the sand. If the bed of the sea be red, the tint of the waters may be either purplish or red. Thus, the waters of the Mediterranean sea in some parts occasionally appear of a purple hue; possibly owing to the red coral which occurs in its bed, combined with the bright sky-blue water. In the Bay of Loango, off the western coast of Africa, the waters always present the appearance of being so strongly tinged with red, that they might be supposed to be mixed with blood. Captain Tuckey, however, satisfied himself that the appearance arose from the intensely red colour of the bed of the ocean in that bay. The reflection of different hues from the bottom of the sea, is not, however, the sole cause of the various colours observed in some parts of the ocean; for it appears that, in many instances, this arises from the presence of innumerable living creatures of minute size. Thus, in the Polar seas, strongly marked bands, or stripes, of green coloured water occur, the tint of which is due to the presence of myriads of semi-transparent medusæ of a yellowish colour, and which, when blended with the blue colour of the ocean, produce this green tint. The colour of the sea, where these medusæ do not occur, is, as has just been mentioned, of an *ultramarine blue*, and beautifully transparent; the green water, on the contrary, has a great degree of opacity. When the

medusæ are very abundant, the water is described by Mr. Scoresby as of nearly a grass-green colour, with a shade of black. The number of the medusæ in the green water was found to be immense, Mr. Scoresby having calculated that a cubic foot of water would contain 110,592 individuals. It is in this olive-green water that the northern *clio*, which forms the principal food of the whale, is chiefly found; it is therefore supposed, that the medusæ are preyed on by the *clio*, itself destined to become the prey of the whale. And here, accordingly, does the great enemy of the latter,—the whale-fisher,—seek for his prize; and thus the whale, whilst pursuing his prey, falls a prey to the rapacity of man.

In other parts, the ocean is of a brown colour, which also appears to be due to the presence of innumerable minute animals; and to a similar cause is attributable the milky-white hue which prevails in some localities. The latter was observed in a remarkable degree by Captain Tuckey, off Cape Palmas, on the coast of Guinea, where the vessel appeared to float in milk. On examination of the water, this white appearance was found to proceed from multitudes of minute animals floating on the surface, which concealed the natural hue of the water. Off the coast of Brazil, the waters of the sea have been observed to present a deep red hue, which is supposed to arise from the occurrence of minute molluscos animals, which float in countless myriads in that part of the ocean; and it is more than probable that the Vermillion sea, near California, has derived its name from a similar cause.

The *phosphorescence*, or *luminosity* of the ocean, is by no means an uncommon, though a very remarkable phenomenon. The luminous appearances thus exhibited on the surface of the sea are very varied. Sometimes a vessel, whilst traversing the ocean, seems to mark out a track of fire, and (if oars be used) each stroke of the oar causes the emission of light, sometimes brilliant and sparkling, and sometimes tranquil and pearly. Sometimes, again, innumerable points glitter over the whole surface of the ocean, whilst at other times, a broad sheet of light extends in all directions; and this, perhaps, may then suddenly break up into a thousand parts, in which an active imagination may conjure up every form and figure. Different causes have been assigned for this phenomenon; but it would appear that although in all probability it occasionally originates in the phosphorescence of decaying organised substances diffused in the waters of the sea, yet the most usual cause of the luminosity of the ocean is the presence of vast numbers of living creatures, which possess the power of emitting light.

With regard to the former class of luminous appearances—that produced by the phosphorescence of decaying organised

substances—it is well known that rotten wood and some kinds of peat earth, as also various animal substances, soon after they are deprived of life, possess the power of emitting spontaneous light. Such appears to be the case more especially with most marine fishes; and, according to a series of experiments made some years since by Dr. Hulme, chiefly with herrings and mackerel, it seems that these fish not only exhibit this lucid appearance themselves shortly after life is extinct, but that they have the power of imparting it to certain solutions in which they may be immersed, and that these solutions actually attain this power of emitting spontaneous light for some time. Thus, Dr. Hulme found that solutions of sea salt, of Epsom salt, &c., when impregnated with some of the luciferous matter scraped from herrings and mackerel, retained the light for several days, which was more especially exhibited when the phial in which they were contained was agitated. The phenomena thus displayed are described by Dr. Hulme as not less surprising than beautiful; for he was enabled to take light from one substance and transfer it to another, so as to render the latter most brilliantly luminous. This luminous matter was obtained in greatest abundance from fish shortly after life had become extinct, and before putrefaction had commenced. These interesting experiments might lead us to conclude that in some instances the luminous appearances exhibited on the surface of the ocean, may arise from the light emitted by marine fishes after life has become extinct, and which is probably removed by friction from the decaying body of the animal, either by the action of a vessel passing through the water, or that of an oar, (to which it may occasionally adhere), or else by the agitation of the waves, which thus becoming impregnated with this luminous matter appear luminous themselves.

The second class of luminous appearances on the surface of the ocean, namely, that produced by living animals, is a yet more remarkable phenomenon than the preceding. The power of emitting spontaneous light appears to be possessed by several inhabitants of the ocean, among which we meet with some crustaceous animals, though the greater number belong to the radiated animals. The most remarkable of the former is the *cancer fulgens*, which in some degree resembles a shrimp in form. The whole body of this creature sometimes appears illuminated, emitting very brilliant scintillations of white light. It is to the *cancer fulgens*, and other nearly similar species of crustaceous animals, that, as we have just seen, Captain Tuckey attributed the white hue of the sea in the Gulf of Guinea. One species, however, when examined in the microscope, presented rather different phenomena from those above described, for the luminous property appeared to be confined to the head

of the animal; the luminous point, when the little creature was at rest, resembled a most brilliant amethyst, but when it moved, flashes of bright silvery light darted from this spot. . . Such being some of the phenomena presented by the various bodies, whether living, or after life is extinct, to which the luminosity of the ocean seems to be attributable, it will be readily supposed, that where these creatures occur in great abundance, the appearances they exhibit are sometimes very imposing and splendid. The phenomenon is displayed in greater lustre in warm climates, but is by no means confined to those regions, being frequently witnessed off our own shores; and Professor Trail mentions that he met with luminous animals belonging to the genera medusa and beroe, in the North Atlantic Ocean, between the thirty-seventh and sixtieth parallels of latitude; and, on one occasion, so brilliant was the luminous appearance of the ocean, that the professor could by this light distinguish letters in a book and also discern the hour on a watch, although in other situations on the deck of the vessel it was so dark, that the features of the seamen could not be distinguished. When the hand was immersed in the luminous water, the shining particles were found adhering to the fingers, and the water was almost invariably observed to contain animals of the genera medusa and beroe.

M. de Tesson observed in False Bay, at the Cape of Good Hope, a remarkable instance of this phenomenon which appeared to be due to the presence of an innumerable quantity of small, hard, spherical bodies, which were in such abundance, that the water was quite thickened by them. On agitating the water with the hand, a slight crackling sound was heard, as when snow is pressed. Some of this water, when strained through a cloth, left half its bulk of these minute animals. The water which had been strained had lost its luminous properties, but the remaining animal matter possessed it in a high degree. Dr. Buchanan, speaking of this phenomenon as witnessed off the coast of Africa, states, that 'soon after dark in the evening, it being nearly calm, we saw numerous lights at a distance, like the lamps of a great city. The lights gradually approached the frigate, and on reaching us, appeared to arise from the circumstance of a great many large fishes in the water, which agitated the animalcules, so as to excite their luminous powers.' Mr. Bennett's observations led him to the conclusion that there are two kinds of luminous appearances presented at the surface of the ocean, the one being produced by various species of medusæ, whilst the other exhibits no indication of the presence of living animals, and which, therefore, may be considered as originating in light emitted from the bodies of decaying marine animals. He observed that the former usually presented the appearance

of sheets or trains of whitish or greenish light, often sufficiently brilliant to illuminate the vessel as it passed through the water; whilst in the latter instance, the surface of the sea appeared studded with scintillations of light of the most vivid description, more particularly when the waves were broken by the violence of the wind, or by the passage of the vessel through the water. Sometimes within the tropics during heavy rains, Mr. Bennett observed that the sea would suddenly become luminous, and the light would as suddenly pass off again; the effect of these rapid transitions being exceedingly splendid and striking to the beholders.

CIRCULATING DECIMALS.

Express as decimal fractions—

$$(1) \frac{1}{8}; \frac{1}{14}; \frac{1}{8}; \frac{1}{25}; \frac{9}{21}; \frac{1}{12}; \frac{5}{28}; \frac{3}{27}; \frac{79}{88}; \frac{1}{184}$$

Express as vulgar fractions—

$$(2) \cdot 3; \cdot 7; \cdot 07; 6\cdot024; \cdot 135; \cdot 583; \cdot 592; \cdot 057; \cdot 12436.$$

Find the sum correct to six places of decimals of—

$$(3) 14\cdot6, 5\cdot07, \cdot6370, \cdot375, 89\cdot425. \quad (4) \cdot057, 6\cdot93, 76\cdot294.$$

$$(5) \cdot478, 6\cdot93, \cdot001, 4\cdot09, \cdot1, \cdot0038. \quad (6) 43\cdot597, 96\cdot2, \cdot4073.$$

Find the difference (correct to seven places of decimals) between—

$$(7) \cdot19378 \text{ and } \cdot16 \cdot 70\cdot8095900 \text{ and } 7\cdot72; 61\cdot297 \text{ and } 4\cdot75.$$

THE BATTLE OF BANNOCKBURN.

1314.

(From 'Tales of a Grandfather,' by Sir Walter Scott.)

ex-pert', skillful
strat'-a-gem, a trick
ter'-mi-na-ted, ended
is'-sue, result, end
Chris'-ten-dom, all the nations professing
Christianity

on'-set, the beginning of an attack
cav'-al-ry, horse-soldiers
in'-fant-ry, foot-soldiers
van, the front of an army
ex-hort', to warn earnestly
val'-iant-ly, bravely

KING EDWARD II., therefore, assembled one of the greatest armies which a king of England ever commanded. There were troops brought from all his dominions. Many brave soldiers from the provinces which the king of England possessed in France,—many Irish, many Welsh,—and all the great English nobles and barons with their followers, were assembled in one great army. The number was not less than one hundred thousand men.

King Robert the Bruce summoned all his nobles and barons to join him, when he heard of the great preparation which the King of England was making. They were not so numerous as the English by many thousand men. In fact, his whole army did not very much exceed thirty thousand, and they were

much worse armed than the wealthy Englishmen; but then, Robert, who was at their head, was one of the most expert generals of the time; and the officers he had under him, were his brother Edward, his nephew Randolph, his faithful follower the Douglas, and other brave and experienced leaders, who commanded the same men that had been accustomed to fight and gain victories under every disadvantage of situation and numbers.

The king, on his part, studied how he might supply by address and stratagem, what he wanted in numbers and strength. He knew the superiority of the English, both in their heavy armed cavalry, which were much better mounted and armed than that of the Scots, and in their archers, who were better trained than any others in the world. Both these advantages he resolved to provide against. With this purpose, he led his army down into a plain near Stirling, called the Park, near which, and beneath it, the English army must needs pass through a boggy country, broken with water-courses, while the Scots occupied hard dry ground. He then caused all the ground upon the front of his line of battle, where cavalry were likely to act, to be dug full of holes about as deep as a man's knee. They were filled with light brushwood, and the turf was laid on the top, so that it appeared a plain field, while in reality it was as full of these pits as a honey-comb is of holes. He also, it is said, caused steel spikes, called calthrops, to be scattered up and down in the plain, where the English cavalry were most likely to advance, trusting in that manner to lame and destroy their horses.

When the Scottish army was drawn up, the line stretched north and south. On the south it was terminated by the banks of the brook called Bannockburn, which was so rocky, that no troops could attack them there. On the left, the Scottish line extended near to the town of Stirling. Bruce reviewed his troops very carefully; all the useless servants, drivers of carts, and such like, of whom there were very many, he ordered to go behind a height, afterwards in memory of the event, called the Gillies' Hill—that is, the Servants' Hill. He then spoke to the soldiers, and expressed his determination to gain the victory, or to lose his life on the field of battle. He desired that all those who did not propose to fight to the last, should leave the field before the battle began; and that none should remain except those who were determined to take the issue of victory or death, as God should send it.

When the main body of his army was thus placed in order, the king posted Randolph, with a body of horse, near to the church of *St. Ninian's*, commanding him to use the utmost diligence to prevent any succours from being thrown into *Stirling castle*. He then despatched James of Douglas, and Sir Rob

Keith, the mareschal of the Scottish army, in order that they might survey, as nearly as they could, the English force, which was now approaching from Falkirk. They returned with information that the approach of that vast host was one of the most beautiful and terrible sights which could be seen—that the whole country seemed covered with men-at-arms on horse and foot—that the number of standards, banners, and pennons (all flags of different kinds), made so gallant a show, that the bravest and most numerous host in Christendom might be alarmed to see King Edward moving against them.

It was upon the 23rd of June 1314, the King of Scotland heard the news, that the English were approaching Stirling. He drew out his army, therefore, in the order which he had before resolved on. After a short time, Bruce, who was looking out anxiously for the enemy, saw a body of English cavalry trying to get into Stirling from the eastward. This was the Lord Clifford, who, with a chosen body of 800 horse, had been detached to relieve the castle.

‘See, Randolph,’ said the king to his nephew, ‘there is a rose fallen from your chaplet.’ By this he meant, that Randolph had lost some honour, by suffering the enemy to pass where he had been stationed to hinder them. Randolph made no reply, but rushed against Clifford with little more than half his number.

The Scots were on foot. The English turned to charge them with their lances, and Randolph drew up his men in close order to receive the onset. He seemed to be in so much danger, that Douglas asked leave to go and assist him. The king refused him permission.

‘Let Randolph,’ he said, ‘redeem his own fault; I cannot break the order of battle for his sake.’ Still the danger appeared greater, and the English horse seemed entirely to encompass the small handful of Scottish infantry. ‘So please you,’ said Douglas to the king, ‘my heart will not suffer me to stand idle and see Randolph perish—I must go to his assistance.’ He rode off accordingly; but long before they had reached the place of combat, they saw the English horses galloping off, many with empty saddles.

‘Halt!’ said Douglas to his men, ‘Randolph has gained the day; since we were not soon enough to help him in the battle, do not let us lessen his glory by approaching the field.’ Now, that was nobly done, especially as Douglas and Randolph were always contending which should rise highest in the good opinion of the king and the nation.

The van of the English army now came in sight, and a number of their bravest knights drew near to see what the Scots were doing. They saw King Robert dressed in his armour, and distinguished by a gold crown which he wore over

his helmet. He was not mounted on his great war-horse, because he did not expect to fight that evening. But he rode on a little pony up and down the ranks of his army, putting his men in order, and carried in his hand a sort of battle-axe made of steel. When the king saw the English horsemen draw near, he advanced a little before his own men, that he might look at them more nearly.

There was a knight among the English, called Sir Henry de Bohun, who thought this would be a good opportunity to gain great fame to himself, and put an end to the war, by killing King Robert. The king being poorly mounted, and having no lance, Bohun galloped on him suddenly and furiously, thinking with his long spear, and his tall powerful horse, easily to bear him down to the ground. King Robert saw him, and permitted him to come very near, then suddenly turned his pony a little to one side, so that Sir Henry missed him with the lance-point, and was in the act of being carried past him by the career of his horse. But as he passed, King Robert rose up in his stirrups, and struck Sir Henry on the head with his battle-axe so terrible a blow, that it broke to pieces his iron helmet as if it had been a nut-shell, and hurled him from his saddle. He was dead before he reached the ground. This gallant action was blamed by the Scottish leaders, who thought Bruce ought not to have exposed himself to so much danger when the safety of the whole army depended on him. The king only kept looking at his weapon, which was injured by the force of the blow, and said, 'I have broken my good battle-axe.' The next morning, being the 24th of June, at break of day, the battle began in terrible interest. The English as they advanced saw the Scots getting into line. The Abbot of Inchaffray walked through their ranks barefooted, and exhorted them to fight for their freedom. They kneeled down as he passed, and prayed to heaven for victory. King Edward, who saw this, called out, 'They kneel down—they are asking forgiveness.' 'Yes,' said a celebrated English baron called Ingelram de Umphrville, 'but they ask it from God, not from us—these men will conquer, or die upon the field.'

The English king ordered his men to begin the battle. The archers bent their bows, and began to shoot so closely together, that the arrows fell like flakes of snow on a Christmas day. They killed many of the Scots, and might, as at Falkirk and other places, have decided the victory; but Bruce, as I told you before, was prepared for them. He had in readiness a body of men-at-arms, well mounted, who rode at full gallop among the archers, and as they had no weapons save their bows and arrows, which they could not use when they were attacked hand to hand, they were cut down in great numbers by the Scottish horsemen, and thrown into total confusion.

The fine English cavalry then advanced to support their archers, and to attack the Scottish line. But coming over the ground which was dug full of pits, the horses fell into these holes, and the riders lay tumbling about, without any means of defence, and unable to rise, from the weight of their armour. The Englishmen began to fall into general disorder; and the Scottish king, bringing up more of his forces, attacked and pressed them still more closely.

On a sudden, while the battle was obstinately maintained on both sides, an event happened which decided the victory. The servants and attendants on the Scottish camp had, as I told you, been sent behind the army, to a place afterwards called the 'Gillies' Hill.' But when they saw that their masters were likely to gain the day, they rushed from their place of concealment with such weapons as they could get, that they might have their share in the victory and in the spoil. The English, seeing them come suddenly over the hill, mistook this disorderly rabble for another army coming to sustain the Scots, and, losing all heart, began to shift every man for himself. Edward left the field as fast as he could ride. A valiant knight, Sir Giles de Argentine, much renowned in the wars of Palestine, attended the king till he got him out of the press of the combat. But he would retreat no farther. 'It is not my custom,' he said, 'to fly.' With that he took leave of the king, set spurs to his horse, and calling out his war-cry of 'Argentine! Argentine!' he rushed into the thickest of the Scottish ranks and was killed.

The young Earl of Gloucester was also slain, fighting valiantly. The Scots would have saved him, but as he had not put on his armorial bearings, they did not know him, and he was cut to pieces.

Edward first fled to Stirling castle, and entreated admittance; but Sir Philip Mowbray, the governor, reminded the fugitive sovereign that he was obliged to surrender the castle next day, so Edward was fain to fly through the Torwood, closely pursued by Douglas with a body of cavalry. An odd circumstance happened during the chase, which showed how loosely some of the Scottish barons of the day held their political opinions. As Douglas was riding furiously after Edward, he met a Scottish knight, Sir Lawrence Abernethy, with twenty horse. Sir Lawrence had hitherto owned the English interest, and was bringing this band of followers to serve King Edward's army. But learning from Douglas that the English king was entirely defeated, he changed sides on the spot, and was easily persuaded upon to join Douglas in pursuing the unfortunate Edward, with the very followers whom he had *been leading to join his standard.*

Douglas and Abernethy continued the chase, not giving King Edward time to alight from horseback even for an instant, and followed him as far as Dunbar, where the English had still a friend in the governor, Patrick, Earl of March. The earl received Edward in his forlorn condition, and furnished him with a fishing skiff, or small ship, in which he escaped to England, having entirely lost his fine army, and a great number of his bravest nobles.

CIRCULATING DECIMALS.

Find the value correct to six places of decimals of—

- (1) $74.297 \times .26$; 54.04×6.973 ; $28.857 \times .72$; $.6329 \times 6.23$.
- (2) $4.418 \times .12$; $.845 \times 96.736$; $64.41 \times .036$; 28.148×4.75 .
- (3) $168.5787 \div .09$; $52.3 \times .3$; $98.54 \div .418$; $10.83 \div .26$.
- (4) $.888 \div .92$; $8 \times .351$; $.098 \div .036$; $36.48 \div .63$.

SCIENTIFIC EXTRACTS.

(From Timbs's 'Curiosities of Science'.)

COMPRESSION OF BODIES.

aug-ment'-ed, increased
 in-cumb'-ent, lying on the top
 in-er'-tia, the property which all matter
 possesses of remaining in the state,
 either of rest or motion, in which it is
 placed until disturbed by some other
 force
 in-fla'-ted, filled with air
 in-ha-la'-tion, the act of breathing in
 in-ex'-plic-a-ble, that cannot be explained
 ful'-crum, that upon which a lever turns
 or rests
 col-lap-sed, to close by falling together
 or'i-gin, the beginning

ex-trem'-i-ty, the end
 a-shro-mat'-io mi'-cro-scope, one through
 which objects appear in their proper
 colours
 fo'-cus, the point where rays of light
 meet; the distance at which a magni-
 fying glass must be placed from the
 object
 sym'-met-ry, beauty of form
 ex-tinct', not now in existence
 po-lar-i-sa'-tion of light, a change pro-
 duced upon light when it passes through
 certain substances

SIR JOHN LESLIE observes, that air, compressed into the fiftieth part of its volume, has its elasticity fifty times augmented; if it continued to contract at that rate, it would, from its own incumbent weight, acquire the density of water at the depth of thirty-four miles. But water itself would have its density doubled at the depth of ninety-three miles, and would attain the density of quicksilver at the depth of three hundred and sixty-two miles. In descending, therefore, towards the centre, though nearly four thousand miles, the condensation of ordinary substances would surpass the utmost powers of conception. Dr. Young says, that steel would be compressed into one-fourth, and stone into one-eighth of its bulk at the earth's centre.

INERTIA ILLUSTRATED.

Many things of common occurrence (says Professor Tyndall) are to be explained by reference to the quality of inactivity. We will here state a few of them.

When a railway train is moving, if it strike against any obstacle which arrests its motion, the passengers are thrown forward in the direction in which the train was proceeding.

Such accidents often occur on a small scale, in attaching carriages at railway stations. The reason is, that the passengers share the motion of the train, and, as matter, they tend to persist in motion. When the train is suddenly checked, this tendency exhibits itself by the falling forward referred to. In like manner, when a train previously at rest is suddenly set in motion, the tendency of the passengers to remain at rest evinces itself by their falling in a direction opposed to that in which the train moves.

LIFTING HEAVY PERSONS.

One of the most extraordinary pages in Sir David Brewster's Letters on Natural Magic is the experiment in which a heavy man is raised with the greatest facility, when he is lifted up the instant that his own lungs, and those of the persons who raise him, are inflated with air. Thus the heaviest person in the party lies down upon two chairs, his legs being supported by the one and his back by the other. Four persons, one at each leg, and one at each shoulder, then try to raise him—the person to be raised giving two signals, by clapping his hands. At the first signal he himself and the four lifters begin to draw a long and full breath; and when the inhalation is completed, or the lungs filled, the second signal is given for raising the person from the chair. To his own surprise, and that of his bearers, he rises with the greatest facility, as if he were no heavier than a feather. Sir David Brewster states that he has seen this inexplicable experiment performed more than once, and he appealed for testimony to Sir Walter Scott, who had repeatedly seen the experiment, and performed the part both of the load and of the bearer. It was first shown in England by Major H., who saw it performed in a large party at Venice, under the direction of an officer of the American navy.

Sir David Brewster (in a letter to 'Notes and Queries,' No. 143) further remarks, that 'The inhalation of the lifters the moment the effort is made, is doubtless essential, and for this reason, when we make a great effort, either in pulling or lifting, we always fill the chest with air previous to the effort; and *when the inhalation is completed we close the rima glottidis to*

keep the air in the lungs. The chest being thus kept expanded, the pulling or lifting muscles have received as it were a fulcrum round which their power is exerted; and we can thus lift the greatest weight the muscles are capable of doing. When the chest collapses by the escape of the air, the lifters lose their muscular power: re-inhalation of air by the liftee can certainly add nothing to the power of the lifters, or diminish his own weight, which is only increased by the weight of the air which he inhales.'

MICROSCOPICAL EXAMINATION OF THE HAIR.

If a hair be drawn between the finger and thumb, from the end to the root, it will be distinctly felt to give a greater resistance and a different sensation to that which is experienced when drawn the opposite way; in consequence, if the hair be rubbed between the fingers, it will only move one way (travelling in the direction of a line drawn from its termination to its origin from the head or body), so that each extremity may thus be easily distinguished, even in the dark, by the touch alone. The mystery is resolved by the achromatic microscope. A hair viewed on a dark ground as an opaque object with a high power, not less than that of a lens of one-thirtieth of an inch focus, and dully illuminated by a cup, the hair is seen to be indented with teeth somewhat resembling those of a coarse round rasp, but extremely irregular and rugged: as these incline all in one direction, like those of a common file, viz. from the origin of the hair towards its extremity, it sufficiently explains the above singular property. This is a singular proof of the acuteness of the sense of feeling, for the said teeth may be felt much more easily than they can be seen. We may thus understand why a razor will cut a hair in two much more easily when drawn against its teeth than in the opposite direction.

SIR DAVID BREWSTER'S KALEIDOSCOPE.

The idea of this instrument, constructed for the purpose of creating and exhibiting a variety of beautiful and perfectly symmetrical forms, first occurred to Sir David Brewster in 1814, when he was engaged in experiments on the polarisation of light by successive reflections between plates of glass. The reflectors were in some instances inclined to each other; and he had occasion to remark the circular arrangement of the images of a candle round a centre, or the multiplication of the sectors formed by the extremities of the glass plates. In repeating at a subsequent period the experiments of M. Biot on the action of fluids upon light, Sir David Brewster placed the

fluids in a trough, formed by two plates of glass cemented together at an angle; and the eye being necessarily placed at one end, some of the cement, which had been pressed through between the plates, appeared to be arranged into a regular figure. The remarkable symmetry which it presented led to Dr. Brewster's investigation of the cause of this phenomenon; and in so doing he discovered the leading principles of the kaleidoscope.

By the advice of his friends, Dr. Brewster took out a patent for his invention, in the specification of which he describes the kaleidoscope in two different forms. The instrument, however, having been shown to several opticians in London, became known before he could avail himself of his patent; and being simple in principle, it was at once largely manufactured. It is calculated that not less than 200,000 kaleidoscopes were sold in three months in London and Paris; though out of this number, Dr. Brewster says, not perhaps 1,000 were constructed upon scientific principles, or were capable of giving anything like a correct idea of the power of his kaleidoscope.

EXTINCT CARNIVOROUS ANIMALS OF GREAT BRITAIN.

Professor Owen has thus forcibly illustrated the carnivorous animals which preyed upon and restrained the undue multiplication of the vegetable feeders. First we have the bear family, which is now represented in this country only by the badger. We were once blest, however, with many bears. One species seems to have been identical with the existing brown bear of the European continent. Far larger and more formidable was the gigantic cave-bear (*Ursus spelæus*), which surpassed in size his grizzly brother of North America. The skull of the cave-bear differs very much in shape from that of its small brown relative just alluded to; the forehead, in particular, is much higher—to be accounted for by an arrangement of air-cells similar to those which we have already remarked in the elephant. The cave-bear has left its remains in vast abundance in Germany. In our own caves, the bones of hyænas are found in greater quantities. The marks which the teeth of the hyæna make upon the bones which it gnaws are quite unmistakable. Our English hyænas had the most indiscriminating appetite, preying upon every creature, their own species amongst others. Wolves, not distinguishable from those which now exist in France and Germany, seem to have kept company with the hyænas; and *Felis spelæa*, a sort of lion, but larger than any which now exists, ruled over all weaker brutes. Here, says Professor Owen, we have the original British Lion. A species of *Machairodus* has left its remains at Kent's Hole,

near Torquay. In England we had also the beaver, which still lingers on the Danube and the Rhone, and a larger species which has been called *Trogontherium* (gnawing beast), and a gigantic mole.

ALL THE RAIN OF THE WORLD.

The Pacific Ocean and the Indian Ocean may be considered as one sheet of water covering an area quite equal in extent to one-half of that embraced by the whole surface of the earth; and the total annual fall of rain on the earth's surface is 186,240 cubic imperial miles. Not less than three-fourths of the vapour which makes this rain comes from this waste of waters; but, supposing that only half of this quantity, that is, 93,120 cubic miles of rain, falls upon this sea, and that that much at least is taken up from it again as vapour, this would give 255 cubic miles as the quantity of water which is daily lifted up and poured back again into this expanse. It is taken up at one place, and rained down at another; and in this process, therefore, we have agencies for multitudes of partial and conflicting currents, all in their set strength, apparently as uncertain as the winds.

The better to appreciate the operation of such agencies in producing currents in the sea, imagine a district of 255 square miles to be set apart in the midst of the Pacific Ocean as the scene of operations for one day; then conceive a machine capable of pumping up in the twenty-four hours all the water to the depth of one mile in this district. The machine must not only pump up and bear off this immense quantity of water, but it must discharge it again into the sea on the same day, but at some other place.

All the great rivers of America, Europe, and Asia are lifted up by the atmosphere, and flow in invisible streams back through the air to their sources among the hills; and through channels so regular, certain, and well-defined, that the quantity thus conveyed one year with the other is nearly the same: for that is the quantity which we see running down to the ocean through these rivers; and the quantity discharged annually by each river is, as far as we can judge, nearly as constant.

DECIMAL FRACTIONS: REDUCTION.

Find the value of—

- (1) £75; £625; £725; £485; £1421; £7863; £416.
- (2) 25s.; 325s.; 1215s.; 4163s.; 8131s.; 8364s.; 236s.
- (3) 145d.; 365d.; 485d.; £675; £845; £925; 45s.
- (4) 75 ton; 564 lb. Troy; 368 oz. Troy; 692 cwt.; 568 qr.; 892 m.; 6731 yard.
- (5) 869 day; 4062 of £2 10s. 6d.; 0321 of 5 hrs. 48 m.; 878 of 18s. 10½d.

SELECTIONS FROM THE POEMS OF MILTON
AND DRYDEN.

THE SPIRIT'S EPILOGUE.

(John Milton.)

[Born, 1608; died, 1674. Chief poems: 'Paradise Lost,' 'Paradise Regained,'
'Comus,' 'Samson Agonistes,' &c.]

wax'-ing, growing
 sphe'-ry, round, belonging to the spheres
 in-su'-per-a-ble, that cannot be overcome
 o-do-rif'-er-ous, fragrant, giving scent
 Tl-mo'-the-us, a Boeotian poet, a fa-
 vourite of Alexander the Great

Hel'-en, wife of Menelaus. She went
 away with Paris, son of Priam, King
 of Troy, and thus caused the Trojan
 War
 en-thu'-si-ast, a person extremely zealous
 in supporting his principles

To the ocean now I fly,
 And those happy climes that lie
 Where day never shuts his eye,
 Up in the broad fields of the sky:
 There I suck the liquid air
 All amidst the gardens fair,
 Of Hesperus, and his daughters three,
 That sing about the golden tree:
 Along the crisped shades and bowers
 Revels the spruce and jocund spring;
 The graces, and the rosy-bosom'd hours,
 Thither all their bounties bring;
 There eternal summer dwells,
 And west winds, with musky wing,
 About the cedar'n alleys fling
 Nard and Cassia's balmy smells.
 Iris there with humid bow
 Waters the odorous banks that blow
 Flowers of more mingled hue
 Than her purpled scarf can show;
 And drenches with Elysian dew
 (List, mortals, if your ears be true,)
 Beds of hyacinth and roses,
 Where young Adonis oft reposes,
 Waxing well of his deep wound
 In slumber soft, and on the ground
 Sadly sits the Assyrian queen:
 But far above in spangled sheen
 Celestial Cupid, her fam'd son, advanc'd,
 Holds his dear Psyche sweet entranc'd.

After her wandering labours long,
 Till free consent the gods among
 Make her his eternal bride,
 And from her fair unspotted side
 Two blissful twins are to be born,
 Youth and Joy; so Jove hath sworn.

But now my task is smoothly done,
 I can fly, or I can run,
 Quickly to the green earth's end,
 Where the bow'd welkin slow doth bend;
 And from thence can soar as soon
 To the corners of the moon.

Mortals that would follow me,
 Love Virtue; she alone is free:
 She can teach ye how to climb
 Higher than the sphery chime;
 Or if Virtue feeble were,
 Heaven itself would stoop to her.

Comus.

THE GARDEN OF EDEN.

So on he fares, and to the border comes
 Of Eden, where delicious Paradise,
 Now nearer, crowns with her inclosure green,
 As with a rural mound, the champaign head
 Of a steep wilderness, whose hairy sides
 With thicket overgrown, grotesque, and wild,
 Access denied; and overhead upgrew
 Insuperable height of loftiest shade,
 Cedar and pine, and fir, and branching palm,
 A sylvan scene, and as the ranks ascend,
 Shade above shade, a woody theatre
 Of stateliest view. Yet higher than their tops,
 The verd'rous wall of Paradise up-sprung:
 Which to our general sire gave prospect large
 Into his nether empire neigh'ring round.
 And higher than that wall a circling row
 Of goodliest trees, loaden with fairest fruit,
 Blossoms and fruits at once of golden hue,
 Appear'd, with gay enamell'd colours mix'd;
 Of which the sun more glad impress'd his beams
 Than in fair evening cloud, or humid bow,
 When God hath shower'd the earth; so lovely seem'd
 That landscape; and of pure, now purer air

Meets his approach, and to the heart inspires
 Vernal delight and joy, able to drive
 All sadness but despair; now gentle gales
 Fanning their odoriferous wings, dispense
 Native perfumes, and whisper whence they stole
 Those balmy spoils: as when to them who sail
 Beyond the Cape of Hope, and now are past
 Mozambic, off at sea north-west winds blow
 Sabeian odours from the spicy shore
 Of Araby the blest; with such delay
 Well pleas'd they slack their course, and many a league,
 Cheer'd with the grateful smell, old Ocean smiles.

Paradise Lost.

ALEXANDER'S FEAST.

(John Dryden.)

[Born, 1631; died, 1700. Chief works: 'Absalom and Achitophel,' 'The Hind and Panther,' Translations of Juvenal, Perseus and Virgil, 'Alexander's Feast,' and various dramatic works.]

'Twas at the royal feast, for Persia won
 By Philip's warlike son:
 Aloft in awful state
 The godlike hero sate
 On his imperial throne:
 His valiant peers were plac'd around,
 Their brows with roses and with myrtle bound:
 So should dessert in arms be crown'd.
 The lovely Thais by his side
 Sat like a blooming Eastern bride,
 In flower of youth and beauty's pride.
 Happy, happy, happy pair;
 None but the brave,
 None but the brave,
 None but the brave deserve the fair.

Timotheus, plac'd on high
 Amid the tuneful quire,
 With flying fingers touch'd the lyre:
 The trembling notes ascend the sky,
 And heavenly joys inspire.
 The song began from Jove,
 Who left his blissful seat above,
 Such is the power of mighty Love!

A dragon's fiery form belied the god :
 Sublime on radiant spheres he rode,
 When he to fair Olympia press'd :
 And while he sought her snowy breast,
 Then round her slender waist he curl'd
 And stamp'd an image of himself, a sovereign of the world.
 The list'ning crowd admire the lofty sound ;
 A present deity, they shout around ;
 A present deity, the vaulted roofs rebound :
 With ravish'd ears
 The monarch hears,
 Assumes the god,
 Affects to nod,
 And seems to shake the spheres.

The praise of Bacchus then the sweet musician sung,
 Of Bacchus ever fair, and ever young :
 The jolly god in triumph comes ;
 Sound the trumpets, beat the drums ;
 The mighty master smil'd to see
 That love was in the next degree :
 'Twas but a kindred sound to move ;
 For pity melts the mind to love.
 Softly sweet in Lydian measures,
 Soon he sooth'd his soul to pleasures,
 War, he sung, is toil and trouble ;
 Honour but an empty bubble ;
 Never ending, still beginning,
 Fighting still, and still destroying ;
 If the world be worth thy winning,
 Think, O think it worth enjoying !
 Lovely Thais sits beside thee,
 Take the good the gods provide thee.
 The many rend the skies with loud applause ;
 So love was crown'd, but music won the cause.
 The prince, unable to conceal his pain,
 Gaz'd on the fair
 Who caus'd his care,
 And sigh'd and look'd, sigh'd and look'd,
 Sigh'd and look'd, and sigh'd again.
 At length, with love and wine at once oppress'd,
 The vanquish'd victor sank upon her breast.

Now strike the golden lyre again ;
 A louder yet, and yet a louder strain.
 Break his bands of sleep asunder,
 And rouse him like a rattling peal of thunder.

Hark! hark! the horrid sound
Has rais'd up his head,
As awak'd from the dead,
And, amaz'd, he stares around.
Revenge, revenge, Timotheus cries,
See the Furies arise;
Flush'd with a purple grace
He shows his honest face.
Now, give the hautboys breath; he comes! he comes!
Bacchus, ever fair and young,
Drinking joys did first ordain:
Bacchus' blessings are a treasure;
Drinking is the soldier's pleasure;
Rich the treasure,
Sweet the pleasure,
Sweet is pleasure after pain.

Sooth'd with the sound the king grew vain,
Fought all his battles o'er again:
And thrice he routed all his foes, and thrice he slew the slain.
The master saw the madness rise;
His glowing cheeks, his ardent eyes;
And, while he heav'n and earth defied,
Chang'd his hand, and check'd his pride.
He chose a mournful muse,
Soft pity to infuse:
He sung Darius, great and good,
By too severe a fate
Fall'n, fall'n, fall'n, fall'n,
Fall'n from his high estate,
And weltring in his blood;
Deserted at his utmost need
By those his former bounty fed,
On the bare earth expos'd he lies,
With not a friend to close his eyes.
With downcast look the joyless victor sate,
Revolving in his alter'd soul
The various turns of fate below;
And now and then a sigh he stole,
And tears began to flow.

See the snakes that they rear!
How they hiss in the air,
And the sparkles that flash from their eyes!
Behold a ghastly band,
Each a torch in his hand!
These are Grecian ghosts that in battle were slain,

And unburied remain
 Inglorious on the plain;
 Give the vengeance due
 To the valiant crew:
 Behold how they toss their torches on high!
 How they point to the Persian abodes,
 And glittering temples of their hostile gods!
 The princes applaud, with a furious joy;
 And the king seized a flambeau with zeal to destroy;
 Thais led the way,
 To light him to his prey,
 And like another Helen, fir'd another Troy.

Thus long ago,
 Ere heaving billows learn'd to blow,
 While organs yet were mute,
 Timotheus to his breathing flute
 And sounding lyre,
 Could swell the soul to rage, or kindle soft desire.
 At last divine Cecilia came,
 Inventress of the vocal frame;
 The sweet enthusiast from her sacred store,
 Enlarg'd the former narrow bounds,
 And added length to solemn sounds,
 With Nature's mother-wit, and arts unknown before.
 Let old Timotheus yield the prize,
 Or both divide the crown:
 He rais'd a mortal to the skies;
 She drew an angel down.

DECIMAL FRACTIONS: REDUCTION.

Reduce	to the decimal of
(1) 5s.; 4s.; 2s. 6d.	£1.
(2) 6s. 8d.; 3s. 4d.; 13s. 4d.	£1.
(3) 19s.; 10s. 6d.; 4s. 8d.	£2.
(4) 18s. 6d.; 11s. 4d.; 12s. 6d.	£3 6s. 10d.
(5) 13s. 6½d.; 12s. 10½d.	£5 6s. 11½d.
(6) £1 3s. 10d.; £2 11s.	£6 7s. 8½d.
(7) 4 cwt. 2 qrs.; 7 cwt. 18 lbs.	3 tons 7 cwt.
(8) 8 sq. ft. 38 in.; 1 sq. yd. 3 ft.	2 sq. yds.
(9) 2 roods 726 yds.; 4 yds.	an acre.
(10) 5 days 1 hr. 6 m.; 58 m. 16 sec.	4 weeks.
(11) 2 qrs. 3 nls.; 1 qr. 2 nls.	2 ells.
(12) 19 c. ft. 196 in.; 22 c. ft. 162 in.	4 c. yds.

THE CHURCH OF THE HOLY SEPULCHRE AT JERUSALEM.

(From 'Sinai and Palestine,' by Dean Stanley.)

Chris-ten-dom, the nations professing
Christianity
e-clip-sed, to darken, to shut out from view
Ro-tun-da, an ancient building at Rome,
formerly called the Pantheon; any cir-
cular building
nave, the central passage in a church
Franks, natives of Western Europe—
English, French, &c.
cu-po-la, a dome
ap-er-ture, an opening
Copts, descendants of the ancient Egyp-
tians

pre'-cinct, a neighbourhood
tran'-quill, quiet
re-min-is'-cence, remembrance
trau'-ry, madness
rit'-u-al, order of religious worship
cri'-sis, pl. crises (Gr.), the point in which
a disease kills or gets better
des'-e-crate, to profane, to treat irre-
verently
sub'-al-dence, a settling down
bas-il'-i-ca, a public hall, church, palace,
&c.

THERE is one more aspect in which the Church of the Holy Sepulchre must be regarded. It is not merely the centre of the worship of Christendom, it is also in an especial manner the cathedral church of Palestine and the East; and in it the local religion, which attaches to all the Holy Places, reaches its highest pitch, and, as is natural, receives its colour from the Eastern and barbarous nations, who necessarily contribute the chief elements to what may be called its natural congregation. It may be well, therefore, to conclude by a description of the Greek Easter, which will also sum up the general impressions of the whole building, in whose history it forms so remarkable a feature. The time is the morning of Easter Eve, which, by a strange anticipation, here, as in Spain, eclipses Easter Sunday. The place is the great Rotunda of the nave, the model of all the circular churches of Europe, especially that of Aix-la-Chapelle. Above is the great dome, with its rents and patches waiting to be repaired, and the sky seen through the opening in the centre, which here, as in the Pantheon, admits the light and air of day. Immediately beneath are the galleries, in one of which on the northern side—that of the Latin convent—are assembled the Frank spectators. Below is the Chapel of the Sepulchre—a shapeless edifice of brown marble; on its shabby roof, a meagre cupola, tawdry vases with tawdry flowers, and a forest of slender tapers; whilst a blue curtain is drawn across its top to intercept the rain admitted through the dome. It is divided into two chapels—that on the west containing the sepulchre, that on the east containing 'The Stone of the Angel.' Of these, the eastern chapel is occupied by the Greeks and Armenians. On its north side is a round hole, from which the holy fire is to issue for the Greeks. A corresponding aperture is on the south side for the Armenians, who communicate it to the Syrians,

Copts, and Abyssinians. At the western extremity of the sepulchre, but attached to it from the outside, is the little wooden chapel allotted to the poor Copts; and further west, but parted from the sepulchre itself, is the still poorer chapel of the still poorer Syrians, happy in their poverty however for this, that it has probably been the means of saving from marble and decoration the so-called tombs of Joseph and Nicodemus, which lie in their precincts, and on which rests the chief evidence of the genuineness of the whole site.

The Chapel of the Sepulchre rises from a dense mass of pilgrims, who sit or stand wedged round it; whilst round them, and between another equally dense mass, which goes round the walls of the church itself, a lane is formed by two lines, or rather two circles, of Turkish soldiers stationed to keep order. For the spectacle which is about to take place nothing can be better suited than the form of the Rotunda, giving galleries above for the spectators, and an open space below for the pilgrims and their festival. For the first two hours everything is tranquil. Nothing indicates what is coming, except that the two or three pilgrims who have got close to the aperture keep their hands fixed in it with a clench never relaxed. It is about noon that this circular lane is suddenly broken through by a tangled group rushing violently round, till they are caught by one of the Turkish soldiers. It seems to be the belief of the Arab Greeks that unless they run round the sepulchre a certain number of times the fire will not come. Possibly, also, there is some strange reminiscence of the funeral games and races round the tomb of an ancient chief. Accordingly, the night before, and from this time forward for two hours, a succession of gambols takes place, which an Englishman can only compare to a mixture of prisoners' base, football and leapfrog, round and round the Holy Sepulchre. First, he sees these tangled masses of twenty, thirty, fifty men, starting in a run, catching hold of each other, lifting one of themselves on their shoulders, sometimes on their heads, and rushing on with him till he leaps off, and some one else succeeds; some of them dressed in sheep skins, some almost naked; one usually preceding the rest as fugleman, clapping his hands, to which they respond in like manner, adding also wild howls, of which the chief burden is—'This is the tomb of Jesus Christ'—'God save the Sultan'—'Jesus Christ has redeemed us.' What begins in the lesser groups soon grows in magnitude and extent, till at last the whole of the circle between the troops is continuously occupied by a race, a whirl, a torrent of these wild figures, like the witches' sabbath in 'Faust,' wheeling round the sepulchre. Gradually the frenzy subsides or is checked; the course is cleared, and out of the Greek church, on the east

of the Rotunda, a long procession with embroidered banners, supplying in their ritual the want of images, begins to defile round the sepulchre. From this moment the excitement, which has before been confined to the runners and dancers, becomes universal.

Hedged in by the soldiers, the two huge masses of pilgrims still remain in their places, all joining, however, in a wild succession of yells, through which are caught from time to time, strangely, almost affectingly, mingled with the chants of the procession—the solemn chants of the church of Basil and Chrysostom, mingled with the yells of savages. Thrice the procession paces round; at the third time the two lines of Turkish soldiers join and fall in behind. One great movement sways the multitude from side to side. The crisis of the day is now approaching. The presence of the Turks is believed to prevent the descent of the fire, and at this point it is that they are driven, or consent to be driven, out of the church. In a moment the confusion, as of a battle and a victory, pervades the church. In every direction the raging mob bursts in upon the troops, and pour out of the church at the south-east corner, the procession is broken through, the banners stagger and waver. They stagger and waver, and fall amidst the flight of priests, bishops, and standard-bearers, hither and thither, before the tremendous rush. In one small but compact band the Bishop of Petra (who is on this occasion the ‘bishop of the fire,’ the representative of the patriarch) is hurried to the Chapel of the Sepulchre, and the door is closed behind him. The whole church is now one heaving sea of heads, resounding with an uproar which can be compared to nothing less than that of the Guildhall of London at a nomination for the city. One vacant space alone is left; a narrow lane from the aperture on the north side of the chapel to the wall of the church. By the aperture itself stands a priest to catch the fire; on each side of the lane, so far as the eye can reach, hundreds of bare arms are stretched out like the branches of a leafless forest—like the branches of a forest quivering in some violent tempest.

In earlier and bolder times, the expectation of the Divine presence was at this juncture raised to a still higher pitch by the appearance of a dove hovering above the cupola of the chapel—to indicate, so Maundrell was told, the visible descent of the Holy Ghost. This extraordinary act, whether of extravagant symbolism or of daring profaneness, has now been discontinued, but the belief still continues, and it is only from the knowledge of that belief that the full horror of the scene, the intense excitement of the next few moments, can be adequately conceived. Silent—awfully silent—in the midst of *this* frantic uproar, stands the Chapel of the Holy Sepulchre.

If anyone could at such a moment be convinced of its genuineness, or could expect a display of miraculous power, assuredly it would be that its very stones would cry out against the wild fanaticism without, and unhappy weakness within, by which it is at that hour desecrated. At last the moment comes. A bright flame, as of burning wood, appears inside the hole—the light, as every educated Greek knows and acknowledges, kindled by the bishop within,—the light, as every pilgrim believes, of the descent of God Himself upon the holy tomb. Any distinct feature or incident is lost in the universal whirl of excitement which envelopes the church, as slowly, gradually, the fire spreads from hand to hand, from taper to taper, through the vast multitude, till at last the whole edifice from gallery to gallery, and through the area below, is one wide blaze of thousands of burning candles. It is now that, according to some accounts, the bishop or patriarch is carried out of the chapel in triumph on the shoulders of the people, in a fainting state, ‘to give the impression that he is overcome by the glory of the Almighty, from whose immediate presence he is believed to come!’ It is now that a mounted horseman, stationed at the gates of the church, gallops off with a lighted taper to communicate the sacred fire to the lamps of the Greek church in the convent at Bethlehem. It is now that the great rush to escape from the rolling smoke and suffocating heat, and to carry the lighted tapers into the streets and houses of Jerusalem, through the one entrance to the church, leads at times to the violent pressure which in 1834 cost the lives of hundreds. For a short time the pilgrims run to and fro—rubbing their faces and breasts against the fire to attest its supposed harmlessness. But the wild enthusiasm terminates from the moment that the fire is communicated; and perhaps not the least extraordinary part of the spectacle is the rapid and total subsidence of a frenzy so intense. The furious agitation of the morning is strangely contrasted with the profound repose of the evening, when the church is once again filled—through the area of the Rotunda, the chapels of Copt and Syrian, the subterranean church of Helena, the great nave of Constantine’s Basilica, the stairs and platform of Calvary itself, with many chambers above—every part, except the one chapel of the Latin church, filled and overlaid by one mass of pilgrims wrapt in deep sleep and waiting for the midnight service.

Such is the Greek Easter, the greatest moral argument against the identity of the spot which it professes to honour—stripped, indeed, of some of its most revolting features, yet still, considering the place, the time, and the intention of the professed miracle, probably the most offensive delusion to be found in the world.

MISCELLANEOUS EXAMPLES.

- (1) Find the value of $6 \cdot 10s. + 4 \cdot 8$ of $44 \cdot 475s. - \frac{2 \cdot 25}{4 \cdot 5}$ of $18 \cdot 8s.$
- (2) Multiply $5s. 3\frac{3}{4}d.$ by $45 \cdot 4235$; and divide $\pounds 8 \ 9s. \ 6d.$ by $35 \cdot 75$.
- (3) Reduce $\frac{2}{83}$ and $\frac{9}{83}$ to decimals; $\cdot 85$ and $\cdot 916$ to vulgar fractions; and $\pounds 4 \ 3s. \ 6\frac{3}{4}d.$ to the decimal of $\pounds 6$.
- (4) If 2 oz. of gold be worth $\pounds 8 \cdot 8999$, what is the value of $3 \cdot 483$ lbs.?
- (5) If 17 lbs. of sugar cost $\pounds 15 \ 6s. \ 8d.$, what would be the cost of 565 cwt.?
- (6) If $16 \cdot 6$ lbs. of tea cost $\pounds 3 \ 4\frac{4}{7}s.$, what would be the cost of 2 cwt.?
- (7) Reduce $\frac{4 \cdot 6 \text{ of } 3 \cdot 73}{2 \cdot 83} + \frac{8 \cdot 5 - 1 \cdot 4}{2 \cdot 65 + 1 \cdot 629}$ of $\frac{5 \cdot 8 \text{ of } 2}{3 \cdot 75}$ to a simple quantity.

THE BATTLE OF CRECI.

(A.D. 1346.)

(From Froissart's Chronicles.)

[Edward III. had invaded France in prosecution of his claim to the crown. The three sons of Philip IV. of France had died without heirs. Isabella, Edward's mother, was Philip's daughter, and he claimed as her heir; but the Salic law, which enacted that no female could inherit the throne, barred his claim, and the nephew of Philip IV. was elected King. The battles of Creci and Poitiers were brilliant victories won in this war, which was concluded, in 1360, by the Treaty of Bretigny, in which Edward renounced all claim to the throne of France, retaining instead Poitou, Guienne, and Calais. The latter town had been taken by the English in 1347, after a year's siege, and remained in their possession till the reign of Mary (1558,) when it was retaken by the French.]

On seeing their enemies advance, the English rose undaunted up, and fell into the ranks; you must know that these kings, earls, barons, and lords of France did not advance in any regular order, but one after the other, in any way most pleasing to themselves. As soon as the King of France came in sight of the English, his blood began to boil, and he cried out to his marshals, 'Order the Genoese forward, and begin the battle, in the name of God and of St. Denis.' There were about fifteen thousand Genoese cross-bowmen, but they were quite fatigued, having marched on foot that day six leagues, completely armed, and with their cross-bows; they told the constable they were not in a fit condition to do any great things that day in battle. The Earl of Alençon hearing this, said, 'This is what one gets by employing such scoundrels, who fall off when there is any need of them.' During this time a heavy rain fell, accompanied by thunder and a very terrible eclipse of the sun, and before the

rain a great flight of crows hovered in the air, over all those battalions, making a loud noise. Shortly afterwards it cleared up and the sun shone very bright, but the Frenchmen had it in their faces and the English had it in their backs. When the Genoese were somewhat in order, and approached the English, they set up a loud shout in order to frighten them, but they remained quite still, and did not seem to attend to it. They then set up a second shout and advanced a little forward, but the English never moved. They hooted a third time, advancing with their cross-bows presented, and began to shoot. The English archers then advanced one step forward, and shot their arrows with such force and quickness that it seemed as if it snowed: when the Genoese felt these arrows, which pierced their arms, heads, and through their armour, some of them cut the strings of their cross-bows, others flung them on the ground, and all turned about and retreated quite discomfited. The French had a large body of men-at-arms on horseback, richly dressed, to support the Genoese.

The King of France seeing them thus fall back, cried out, 'Kill me those scoundrels, for they stop our road without any reason.' You would then have seen the above-mentioned men-at-arms lay about them, killing all they could of these runaways. The English continued shooting as vigorously and quickly as before; some of their arrows fell among the horsemen, who were sumptuously equipped, and killing and wounding many, made them caper and fall among the Genoese, so that they were in such confusion they could never rally again. In the English army there were some Cornish and Welshmen on foot, who had armed themselves with large knives: these, advancing through the ranks of the men-at-arms and archers, who made way for them, came upon the French when they were in this danger, and falling upon earls, barons, knights, and squires, slew many, at which the King of England was afterwards much exasperated. The Earl of Alençon advanced in regular order upon the English to fight with them, as did the Earl of Flanders in another part. These two lords with their detachments, coasting, as it were, the archers, came to the prince's battalion, where they fought valiantly for a length of time. The King of France was eager to march to the place where he saw their banners displayed, but there was a hedge of archers before him. This battle, which was fought on Saturday (August 26, 1346), between La Broyes and Creci, was very murderous and cruel, and many gallant deeds of arms were performed that were never known. Towards evening many knights and squires of the French had lost their masters; they wandered up and down the plain, attacking the English in small parties: they were soon destroyed, for the

English had determined that day to give no quarter. Early in the day some French, Germans, and Savoyards had broken through the archers of the prince's battalion, and had engaged with the men-at-arms; upon which the second battalion came to his aid; and it was time, for otherwise he would have been hard pressed. The first division, seeing the danger they were in, sent a knight (Sir Thomas Norwich) in great haste to the King of England, who was posted on an eminence near a windmill. On the knight's arrival, he said, 'Sir, the Earl of Warwick, the Lord Stafford, the Lord Reginald Cobham, and the others who are about your son, are vigorously attacked by the French; and they entreat that you would come to their assistance with your battalion, for, if their numbers should increase, they fear he will have too much to do.' The king replied, 'Is my son dead, unhorsed, or so badly wounded that he cannot support himself?' 'Nothing of the sort, thank God!' rejoined the knight, 'but he is in so hot an engagement that he has great need of your help.' The king answered—'Now, Sir Thomas, return back to those that sent you, and tell them from me not to send to me again this day, or expect that I shall come, let what will happen, as long as my son has life; and say that I command them to let the boy win his spurs; for I am determined, if it please God, that all the glory and honour of the day shall be given to him, and to those in whose care I have entrusted him.'

The knight returned to his lords, and related the king's answer, which mightily encouraged them, and made them repent that they had ever sent such a message. The French, though they fought lustily, could not resist the force of the English, and, spite of their prowess, were borne down on every hand. The Earls Aumarle, St. Pol, Auxerre, Flanders, Blois (nephew of the King of France), and the Duke of Lorraine (the King of France's brother-in-law), with very many gallant knights and squires were slain, and the King of France, who had not about him more than sixty men, every one included, was led away by force from the field by Sir John de Harcourt, first to the castle of La Broyes, where he stayed but to take some refreshment, and then on in the night to Amiens. This Saturday the English never quitted their ranks in pursuit of anyone, but remained in the field guarding their position, and defending themselves against all who attacked them. The battle was ended at the hour of vespers. When, on the Saturday night, the English heard no more hooting or shouting, nor any more crying out to particular lords or their banners, they looked upon the field as their own, and their enemies as beaten; they made great fires, and lighted torches, because of the obscurity of the night. King Edward then came down from his post,

who all the day had not put on his helmet, and, with his whole battalion, advanced to the Prince of Wales, whom he embraced in his arms and kissed, and said: 'Sweet son, God give you good perseverance; you are my son, for most loyally have you acquitted yourself this day: you are worthy to be a sovereign.' The prince bowed down very low, and humbled himself, giving all honour to the king his father.

DECIMAL COINAGE.

Table.—The £ taken as the unit of reference,—10 mils. = 1 cent, 1 c.; 10 cents = 1 florin, 1 fl.; 10 florins = £1.

- (1) Reduce £34 5 fl. 8 c. 7 m.; £48 9 fl. 4 c. 6 m.; £82 8 fl. 8 c. 4 m.; £93 7 fl. 4 m.; £47 5 c. 6 m. to mils.
- (2) Reduce 86978 m.; 56843 m.; 96889 m.; 58679 m.; 896791 m.; to £ fl. c. and m.
- (3) Reduce £27 8 fl. 9 c.; £56½; £476 8½ fl.; £569 1 fl. 6½ c.; £84½; £96 7 fl. 5½ c. to mils.
- (4) £78 8 fl. 6 c. 7 m. + £29 9 fl. 8 c. 9 m. + £986 4 fl. 8 c. 7 m. + £326 9½ fl. + £57 5 fl. 8 c.
- (5) £64 7 fl. 2 c. 3 m. — £37 8 fl. 9 c. 4 m.; £46 3 fl. 7 c. 2 m. — (£29 4½ fl. + £7 3 fl. 2 c.).

THE NATURE AND INFLUENCE OF DECAY.

(From 'Chemical Letters,' by Professor Liebig.)

or-gan'-ic, consisting of different parts,
like a plant or an animal having sepa-
rate organs
ex-tinc'-tion, destruction
vital, relating to life
tem'-po-ra-ry, existing for a short time
only
prim'-e-val, as it existed in the earliest
times
fa-cil'-i-tate, to make easy
Ta'-ci-tus, a Roman historian who lived
in the first century A.D.
im-pen'-e-tra-ble, not easy to see or get
through
hu'-mus, decayed vegetable matter which
gives a brown colour to the soil

mol-lus'-ca, animals which have no in-
ternal skeleton
ox'-i-dise, to combine with oxygen; to
rust
per and se (Lat.), by itself
ex-tra'-ne-ous, outward, acting from with-
out
co-he'-sion, the act of sticking or holding
together
ab-sorp'-tion, the act of absorbing or
sucking in
ni-tro'-gen-ous, formed of nitrogen
al'-co-hol, spirits of wine
sac'-cha-rine, consisting of or containing
sugar

No organised substance, no part of any plant or animal, after the extinction of the vital principle, is capable of resisting the chemical action of air and moisture; for all that power of resistance which they temporarily possessed as the bearers of life, the media of the vital manifestations, completely ceases with the death of the organism; their elements fall again under the unlimited dominion of the chemical forces.

The clearing of the primeval forests of America, facilitating the access of air to that soil, so rich in vegetable remains, alters gradually, but altogether, its constitution: after the lapse of a few years no trace of organic remains can be found in it. The soil of Germany, in the time of Tacitus, was covered with a dense, almost impenetrable forest: it must, at that period, have exactly resembled the soil of America, and have been rich in humus, and vegetable substances; but all the products of vegetable life in those primeval forests have completely vanished from our perceptions. The innumerable millions of molluscous and other animals whose remains form extensive geological formations and mountains, have, after death, passed into a state of fermentation and putrefaction, and subsequently, by the continuous action of the atmosphere, all their soft parts have been transposed into gaseous compounds, and their shells and bones, their indestructible constituents, alone remain.

It is only in localities, under peculiar circumstances, where the access of oxygen was limited or altogether precluded, that we still find distinct remains of primeval vegetables in a state of retarded or impeded decay, as, for example, in beds of turf and brown coal.

The presence of water, and a suitable temperature, are indispensable conditions of the oxidising process of decay, just as they are necessary to putrefaction and fermentation. Perfect dryness, or a temperature below the freezing point, suspends all processes of decay and fermentation. The transmission of decomposition from one particle to another presupposes a change of place; it requires that the particles should possess mobility, or the power of free motion, and this is imparted to them by the presence of water. In decay it is more especially a certain elevated temperature which increases the aptitude of the elements of organic substances to combine with the oxygen of the atmosphere. A great number of organic bodies, when in a moist state, are capable of absorbing oxygen, whilst many, and indeed most of them, are *per se* entirely deficient in this respect.

If we place wet sawdust, or moistened fragments of wood, in a vessel filled with atmospheric air, all the properties of the contained air become in a very short time completely altered. If a lighted splinter—which of course would burn in atmospheric air—is introduced after the lapse of two or three hours, its flame will be immediately extinguished. The air confined in the vessel, if examined, will be found to have lost all its oxygen, and to have acquired an equal volume of carbonic acid gas. If a fresh supply of atmospheric air is made to replace *this*, the same process again occurs—all the oxygen becomes converted into carbonic acid.

In the process of bleaching in the open air, or, as it is called, grass-bleaching, we have the process of decay applied to an important purpose in the arts upon a large scale. Linen or cotton textures consist of ordinary woody fibre, more or less coloured by extraneous organic substances, which were either contained in the plant whence the fibre has been derived, or have become mixed with it during the process of preparation.

When linen or cotton fabrics are moistened with water and exposed to the light of the sun, a slow process of combustion, or decay, immediately begins upon the whole surface: the oxygen of the atmosphere in immediate contact with the linen or cotton is incessantly converted into carbonic acid. The weight of the fabric diminishes every second, precisely because it is in a state of combustion; all the colouring matters gradually disappear, and with them a considerable amount of woody fibre, their elements being converted into oxygen compounds. If this action of air and light upon the linen or cotton continues for a considerable time, these substances lose their cohesion and become converted into a matter similar to that used in the manufacture of paper, and this matter still continues to decay as long as the essential condition of this change, that is, the absorption of oxygen, proceeds.

The nitrogenous constituents of plants and animals comport themselves towards oxygen in a manner precisely similar to the behaviour of the non-nitrogenous principle we have spoken of, namely, woody fibre. Fresh meat, as well as the first products of the decomposition of the nitrogenous constituents of plants in fermentation, that is, beer yeast, or wine yeast, withdraw oxygen from atmospheric air, and, like woody fibre, yield in return an equal volume of carbonic acid.

When the Cemetery of the Innocents at Paris was removed from the interior of the town to the outside of the barriers, the buried corpses, which had accumulated to a depth of sixty feet, were found to a great extent apparently converted into fat.

The substance of the skin, muscles, cellular tissue, and tendons, all the soft parts, and even the bones, had completely disappeared, leaving only the fat, which, resisting longest the influence of decay, remained in the form of margaric acid.

This human fat was employed to the extent of many tons by the soap-boilers and tallow-chandlers of Paris, for the manufacture of soap and candles.

If meat be suspended in running water, or buried in moist earth, nothing of it will remain after the lapse of some time, except the fat which it contains. All substances susceptible of decay, when in a moist state, and exposed to the air and light at the common temperature, undergo precisely the same change

as they would if exposed to a red heat in a dry state, that is, they absorb oxygen—they undergo combustion.

Alcohol, one of the products of the fermentation of saccharine vegetable juices, is altogether incapable of undergoing the process of decay; when exposed to the air, whether in its pure state or mixed with water, it evaporates without combining with oxygen. Alcohol is readily inflammable at a higher temperature, and in burning is resolved into carbonic acid and water. It is obvious that its elements have a powerful affinity for oxygen: the high temperature is, however, a necessary condition of the manifestation of this affinity. Hydrogen gas and many other inflammable substances are, in this respect, precisely similar to alcohol; their affinity for oxygen manifests itself only at certain high temperatures.

DECIMAL COINAGE.

Reduce in the decimal coinage (to decimals true to the third place):

- (1) £5 9s. 4d.; £7 1s. 7d.; £74 4s. 6½d.; £3 3s. 3d.; £4 1s. 7½d.

Reduce to the ordinary coinage:

- (2) £38 6 fl. 8 c. 8 m.; £50 7 fl. 4 c.; £45-986; £782-809.

Reduce to decimal coinage (true to the third place) and to the ordinary coinage:

- (3) £34 13s. 7½d.; £4 14s. 8½d.; £819 2s.; £549 12s. 6d.: £6-92; £17-703.

Work the following sums, giving each answer in the decimal coinage:

- (4) £75 14s. 9d. × 47; £368 19s. 6½d. ÷ 54; £46 11s. 6d. × 27.
(5) Find the value of 6 cwt. 3 qrs. 14 lbs. @ £28 16s. 4d. per cwt.

THE VOICES OF BIRDS.

(From the 'Natural History of Selbourne,' by Rev. Gilbert White.)

viz'-ier, the Turkish Prime Minister
de-vas-ta'-tion, a laying waste
el-lip'-ti-cal, having words omitted which
are to be understood
nid-i-fi-ca'-tion, nest-building
vox hu-ma-na (Lat.), the human voice
men'-ace (n.), a threat
se-ren-ad'e' (v.), to entertain with music
out of doors at night
cas-ta-nets', small pieces of wood or ivory
which dancers rattle together
gre-ga'-ri-ous, living in flocks

pas'-ser-es (Lat.), sparrows and birds
similar to them
hi-run'-dines (Lat.), swallows and birds
similar to them
a-quat'-ic, living near or on the water
noc-turn'-al, nightly
lo-quas'-cious, talkative
vo-cab'-u-lar-y, a stock of words
chant'-i-cleer, the cock that crows
a-droit'-ly, cleverly, dexterously
re-tal'-i-a'-tion, doing evil for evil

Selbourne, September 9, 1778.

DEAR SIR,—From the motion of birds, the transition is natural enough to their notes and language, of which I shall say

something. Not that I would pretend to understand their language like a vizier, who, by the recital of a conversation which passed between two owls, reclaimed a sultan, before delighting in conquest and devastation; but I would be thought only to mean, that many of the winged tribes have various sounds and voices adapted to express their various passions, wants, and feelings, such as anger, fear, love, hatred, hunger, and the like. All species are not equally eloquent; some are copious and fluent, as it were, in their utterance, while others are confined to a few important sounds; no bird, like the fish kind, is quite mute, though some are rather silent. The language of birds is very ancient, and like other ancient modes of speech, very elliptical; little is said, but much is meant and understood.

The notes of the eagle kind are shrill and piercing; and about the season of nidification much diversified, as I have been often assured by a curious observer of nature, who long resided at Gibraltar, where eagles abound. The notes of our hawks much resemble those of the king of birds. Owls have very expressive notes; they hoot in a fine vocal sound, much resembling the *vox humana*, and reducible by a pitch-pipe to a musical key. This note seems to express complacency and rivalry among the males; they use also a quick call and an horrible scream; and can snore and hiss when they mean to menace. Ravens, besides their loud croak, can exert a deep and solemn note that makes the woods to echo; the amorous sound of a crow is strange and ridiculous; rooks, in the breeding season, attempt sometimes, in the gaiety of their hearts, to sing, but with no great success; the parrot kind have many modulations of voice, as appears by their aptitude to learn human sounds; doves coo in an amorous and mournful manner, and are emblems of despairing lovers; the woodpecker sets up a sort of loud and hearty laugh; the fern-owl, or goat-sucker, from the dusk till daybreak, serenades his mate with the clattering of castanets. All the tuneful *passeres* express their complacency by sweet modulations, and a variety of melody. The swallow, as has been observed in a former letter, by a shrill alarm, bespeaks the attention of the other *hirundines*, and bids them be aware that the hawk is at hand. Aquatic and gregarious birds, especially the nocturnal, that shift their quarters in the dark, are very noisy and loquacious,—as cranes, wild geese, wild ducks, and the like: their perpetual clamour prevents them from dispersing and losing their companions.

In so extensive a subject, sketches and outlines are as much as can be expected; for it would be endless to instance in all the infinite variety of the feathered nation. We shall, therefore, confine the remainder of this letter to the few domestic

fowls of our yards, which are most known, and, therefore, best understood. And first, the peacock, with his gorgeous train, demands our attention; but, like most of the gaudy birds, his notes are grating and shocking to the ear; the yelling of cats, and the braying of an ass, are not more disgusting. The voice of the goose is trumpet-like, and clanking; and once saved the Capitol at Rome, as grave historians assert: the hiss, also, of the gander is formidable, and full of menace, and 'protective of his young.' Among ducks, the sexual distinction of voice is remarkable; for, while the quack of the female is loud and sonorous, the voice of the drake is inward, and harsh, and feeble, and scarce discernible. The cock turkey struts and gobbles to his mistress in a most uncouth manner: he hath also a pert and petulant note when he attacks his adversary. When a hen turkey leads forth her young brood, she keeps a watchful eye; and if a bird of prey appear, though ever so high in the air, the careful mother announces the enemy with a little inward moan, and watches him with a steady and attentive look; but if he approach, her note becomes earnest and alarming, and her outcries are redoubled.

No inhabitants of a yard seem possessed of such a variety of expression, and so copious a language, as common poultry. Take a chicken of four or five days old, and hold it up to a window where there are flies, and it will immediately seize its prey with little twitterings of complacency; but if you tender it a wasp or a bee, at once its note becomes harsh, and expressive of disapprobation and a sense of danger. When a pullet is ready to lay, she intimates the event by a joyous and easy soft note. Of all the occurrences of their life, that of laying seems to be the most important; for no sooner has a hen disburdened herself, than she rushes forth with a clamorous kind of joy, which the cock and the rest of his mistresses immediately adopt. The tumult is not confined to the family concerned, but catches from yard to yard, and spreads to every homestead within hearing, till at last the whole village is in an uproar. As soon as a hen becomes a mother, her new relation demands a new language; she then runs clucking and screaming about, and seems agitated as if possessed. The father of the flock has also a considerable vocabulary: if he finds food, he calls a favourite hen to partake; and if a bird of prey passes over, with a warning voice he bids his family beware. The gallant chanticleer has at command his amorous phrases, and his terms of defiance. But the sound by which he is best known is his crowing: by this he has been distinguished in all ages as the countryman's clock or *larum*,—as the watchman that proclaims the divisions of the night.

Thus the poet elegantly styles him

— the crested cock, whose clarion sounds
The silent hours.

A neighbouring gentleman, one summer, had lost most of his chickens by a sparrow-hawk, that came gliding down between a fagot pile and the end of his house to the place where the coops stood. The owner, inwardly vexed to see his flock thus diminishing, hung a setting net adroitly between the pile and the house, into which the caitiff dashed, and was entangled. Resentment suggested the law of retaliation; he, therefore, clipped the hawk's wings, cut off his talons, and fixing a cork on his bill, threw him down among the brood-hens. Imagination cannot paint the scene that ensued; the expressions that fear, rage, and revenge inspired, were new, or at least such as had been unnoticed before. The exasperated matrons upbraided—they execrated—they insulted—they triumphed. In a word, they never desisted from buffeting their adversary till they had torn him in a hundred pieces.

MISCELLANEOUS EXAMPLES IN VULGAR AND DECIMAL FRACTIONS.

- (1) Find the value of $(11\frac{1}{2} - 7\frac{5}{8} - 3\frac{5}{8}) \times 6\frac{1}{2} \times (9\frac{1}{10} + 3\frac{1}{4})$; and of $\frac{3}{4} + 1\frac{2}{3} + (\frac{1}{2} \text{ of } 2\frac{2}{3})$.
- (2) A person owes £5 10s. 6d. to each of 6 creditors; he pays one $\frac{1}{3}$ of his debt, to another $\frac{2}{5}$, to another $\frac{1}{4}$, to another $\frac{1}{5}$, to another $\frac{1}{10}$, and to another $\frac{1}{18}$; how much does he still owe altogether?
- (3) If $\frac{2}{5}$ of a ship be worth £25,960 16s. 7d., what share is worth £17,842 19s. 6d.?
- (4) If 2 lbs. of tea cost '8964 of 10s., what is the value of '36728 lbs.?
- (5) Multiply £528 3 fl. 4 c. by 28, divide the product by 34, and reduce the result thus obtained to the ordinary coinage.
- (6) How much land will supply 65 horses with hay and oats, if one horse consume annually the produce of 6 a. 2 r. 28 p.?

CORAL ISLANDS (ATOLLS AND LAGOONS).

(From 'Physical Geography,' by Mrs. Somerville.)

de-tri'-bus (Lat.), that which is worn
away
ex-u'-ber-ant, abundant, plentiful
e'-lon-gate, to lengthen, to draw out
di-am'-e-ter, a line drawn through the
centre of a circle terminated both ways
by the circumference
con-tin'-u'-i-ty, uninterrupted connection
lim'-pid, clear, pure

un-fath'-om-a-ble, that cannot be sounded
by a line
a-na'-lo-gy, resemblance, similarity, pro-
portion
sub-ma-rine', being or acting under the
sea
pol'-y-pus (Lat.) (pl. pol'-y-pi), a sea
animal with many feet

AN atoll, or lagoon island, consists of a chaplet or ring of coral, enclosing a lagoon, or portion of the ocean, in its centre.

The average breadth of the part of the ring above the surface of the sea is about a quarter of a mile, oftener less, and it seldom rises higher than from 6 to 10 or 12 feet above the waves. Hence the lagoon islands are not discernible at a very small distance, unless when they are covered with the cocoa-nut, palm, or the pandana, which is frequently the case. On the outer side this ring or circlet shelves down to the distance of 100 or 200 yards from its edge, so that the sea gradually deepens to 25 fathoms, beyond which the sides plunge at once into the unfathomable depths of the ocean, with a more rapid descent than the cone of any volcano. Even at the small distance of some hundred yards, no bottom has been found with a sounding-line a mile and a half long. All the coral at a moderate depth below water is alive—all above is dead, being the detritus of the living part washed up by the surf, which is so tremendous on the windward side of the tropical islands of the Pacific and Indian Oceans that it is often heard miles off, and is frequently the first warning to seamen of their approach to an atoll.

On the lagoon side, where the water is calm, the bounding-ring, or reef, shelves into it by a succession of ledges, also of living coral, though not of the same species with those which build the exterior wall and the foundations of the whole ring. The perpetual change of water brought into contact with the external coral by the breakers probably supplies them with more food than they could obtain in a quieter sea, which may account for their more luxuriant growth. At the same time, they deprive the whole of the corals in the interior of the most nourishing part of their food, because the still water in the lagoon, being supplied from the exterior by openings in the ring, ceases to produce the hardier corals; and species of more delicate forms, and of much slower growth, take their place. The depth of the lagoon varies, in different atolls, from 20 to 50 fathoms, the bottom being partly detritus and partly live coral. By the growth of the coral some few of the lagoons have been filled up, but the process is very slow from the causes assigned, and also because there are marine animals that feed on the living coral, and prevent its indefinite growth. In all departments of nature the exuberant increase of any one class is checked and limited by others. The coral is of the most varied and delicate structure, and of the most beautiful tints. Dark brown, vivid green, rich purple, pink, deep blue, peach colour, yellow, with dazzling white, contrasted with deep shadows, shine through the limpid water; while fish of the most gorgeous hues swim among the branching coral, which are of many different kinds, though all combine in the structure of these

singular islands. Lagoon islands are sometimes circular, but more frequently oval or irregular in their form. Sometimes they are solitary, or in groups, but they occur most frequently in elongated archipelagos, with the atolls elongated in the same direction. The grouping of atolls bears a perfect analogy to the grouping of the archipelagos of ordinary islands.

The size of atolls varies from two to ninety miles in diameter, and islets are frequently formed on the coral rings by the washing up of the detritus, for they are so low that the waves break over them in high tides or storms. They have openings or channels in their circuit, generally on the lee-side, where the tide enters, and by these ships may sail into the lagoons, which are excellent harbours; and even on the surface of the circlet or reef itself there are occasionally boat channels between the islets. Dangerous Archipelago, lying east of the Society Islands, is one of the most remarkable assemblages of atolls in the Pacific Ocean. There are eighty of them, generally of a circular form, surrounding very deep lagoons, and separated from each other by profound depths. The reefs or rings are about half a mile wide, and seldom rise more than 10 feet above the edge of the surf, which beats on them with such violence that it may be heard at the distance of eight miles; and yet on that side the coral insects build more vigorously, and vegetation thrives better, than on the other. Many of the islets are inhabited.

The Caroline Archipelago, the largest of all, lies north of the equator, and extends its atolls in 60 groups over 1,000 miles. Many are of great size, and all are beat by a tempestuous sea and occasional hurricanes. The atolls in the Pacific Ocean and China Sea are beyond enumeration. Though less frequent in the Indian Ocean, none are more interesting, or afford more perfect specimens of this peculiar formation, than the Maldiva and Laccadive archipelagos, both nearly parallel to the coast of Malabar, and elongated in that direction. The former is 470 miles long, and about 50 miles broad, with the atolls arranged in a double row, separated by an unfathomable sea, into which their sides descend with more than ordinary rapidity. The largest atoll is 88 miles long, and somewhat less than 20 broad. Suadiva, the next in size, is 44 miles by 23, with a large lagoon in its centre, to which there is access by 42 openings. There are inhabited islets on most of the chaplets or rings not higher than 20 feet, while the rings themselves are nowhere more than 6 feet above the surge.

The Laccadives run to the north of this archipelago in a double line of nearly circular atolls, on which are low inhabited islets.

Encircling reefs differ in no respect from atoll reefs, except

that they have one or more islands in their lagoon. They commonly form a ring round mountainous islands, at a distance of two or three miles from the shore, rising on the outside from a very deep ocean, and separated from the land by a lagoon or channel 200 or 300 feet deep. These reefs surround the submarine base of the island, and, rising by a steep ascent to the surface, they encircle the island itself. The Caroline Archipelago already mentioned, exhibits good examples of this structure in the encircled islands of Hogolen and Seniavine: the narrow ring or encircling reef of the former is 135 miles in its very irregular circuit, on which are a vast number of islets; but six or eight islands rise to a considerable height from its lagoon, which is so deep, and the opening into it so large, that a frigate might sail into it. The encircling reef of Seniavine is narrow and irregular, and its lagoon is so nearly filled by a lofty island, that it leaves only a strip of water round it from two to five miles wide and 30 fathoms deep.

Otaheite, the largest of the Society group, is another instance of an encircled island of the most beautiful kind; it rises in mountains 7,000 feet high, with only a narrow plain along the shore, and, except where cleared for cultivation, it is covered with forests of cocoa-nut, palms, bananas, bread-fruit, and other productions of a tropical climate. The lagoon, which encompasses it like an enormous moat, is 30 fathoms deep, and is hemmed in from the ocean by a coral band of the usual kind, at a distance varying from half a mile to three miles.

Barrier reefs are of precisely the same structure as the two preceding classes, from which they only differ in their own position with regard to the land. A barrier reef off the north-east coast of the continent of Australia is the grandest coral formation existing. Rising at once from an unfathomable ocean, it extends 1,000 miles along the coast, with a breadth varying from 200 yards to a mile, and at an average distance of from 20 to 30 miles from the shore, in some places increasing to 60 and even 70 miles. The great arm of the sea included between it and the land is nowhere less than 10, occasionally 60 fathoms deep, and is safely navigable throughout its whole length, with a few transverse openings, by which ships can enter. The reef is really 1,200 miles long, because it stretches nearly across Torres Straits. There are also extensive barrier reefs on the islands of Louisiade and New Caledonia, which are exactly opposite to the great Australian reef, and as atolls stud that part of the Pacific which lies between them, it is called the Coralline Sea. The rolling of the billows along the great Australian reef has been admirably described. 'The long ocean-swell, being suddenly impeded by this barrier, lifted itself in one great continuous ridge of deep blue water, which,

curling over, fell on the edge of the reef in an unbroken cataract of dazzling white foam. Each line of breaker runs often one or two miles in length with not a perceptible gap in its continuity. There was a simple grandeur and display of power and beauty in this scene that rose even to sublimity. The unbroken roar of the surf, with its regular pulsation of thunder, as each succeeding swell fell first on the outer edge of the reef, was almost deafening, yet so deep-toned as not to interfere with the slightest nearer and sharper sound. . . . Both the sound and sight were such as to impress the spectator with the consciousness of standing in the presence of an overwhelming majesty and power.*

Coral reefs are distinct from all the foregoing; they are merely fringes of coral along the margin of a shore, and, as they line the shore itself, they have no lagoons. A vast extent of coast, both on the continents and islands, are fringed by these reefs, and, as they frequently surround shoals, they are very dangerous. Lagoon islands are the work of various species of coral insects; but those particular polypi which build the profound external wall, the foundation and support of the whole ring or reef, are most vigorous when most exposed to the breakers; they cannot exist at a greater depth than 25 or 30 fathoms at most, and die immediately when left dry, yet the coral wall descends precipitously to unfathomable depths; and although the whole of it is not the work of these insects, yet the perpendicular thickness of the coral is known to be very great, extending hundreds of feet below the depth at which these polypi cease to live. From an extensive survey of the coralline seas of the tropics, Mr. Darwin has found an explanation of the singular phenomena in the instability of the crust of the earth.

TARE AND TRET.

- (1) If 1 cwt. of butter cost £3, what will be the price of 125 firkins: gross weight 6 tons 7 cwt. 2 qrs. 21 lbs.; tare 11 lbs. per firkin?
- (2) What is the price of 8 cwt. 21 lbs., at 9s. 2½d. per cwt., allowing the usual tret?
- (3) What is to be paid for 8 cwt. 3 qrs. 11 lbs. of rice at 15s. 6d. per cwt., allowing the usual tret?
- (4) What is the price of 800 raw hides at 19s. 10d. per cwt.: gross weight 16 tons 6 cwt. 3 qrs. 15 lbs.; tret 4 lbs. per hide?
- (5) What must I pay for 2 hhds. of tallow, No. 1 weighing 10 cwt. 1 qr. 11 lbs., tare 3 qrs. 20 lbs.; and No. 2, 11 cwt. 17 lbs.; tare, 3 qrs. 14 lbs.; tret for the whole, 1 lb. per cwt.; price 30s. per cwt?

* Mr. Jukes.

THE BATTLE OF AGINCOURT.

(From 'Agincourt,' by Sir Harris Nicolas.)

*cote-d'armes, coat-of-arms, now called
'tabards,' and worn only by heralds
ne-go-ci-a-tion, the act of treating with
in-tre-pid'-i-ty, fearlessness, courage
im-per'-a-tive, commanding
mas'-sa-cre, slaughter
in-fu'-ri-a-ted, enraged*

*van, the front of an army
co-lor'-i-ty, speed, quickness
im-pet-u-os'-i-ty, violence
im-pede', to hinder
pal'-li-ate, to excuse, to lessen
ap-pal'-ling, terrifying, horrible*

[Henry V. revived the claim of the English Kings to the throne of France. He invaded that country, and the result of the battle of Agincourt was a treaty by which it was agreed that Henry should succeed the reigning monarch Charles VI., marry the Princess Katherine, and be Regent of the Kingdom during the King's life.]

At daybreak on Friday, October 25, 1415, the French army drew up in order of battle, in three lines, on the plain of Agincourt, through which was the route to Calais. As soon as they were formed they seated themselves in companies, as near as possible to their respective banners, awaiting with full confidence of victory the approach of the English. Henry rose at the earliest dawn, and immediately heard mass; he was habited in his *cote d'armes*, containing the arms of France and England quarterly, and wore on his bacinet a magnificent crown. Being equipped for action, he mounted a small grey horse, and without commanding the trumpets to sound, ordered his men out of their quarters, and drew them up in order of battle upon a fine plain of young corn.

The main body of the English army, consisting of men-at-arms, was commanded by Henry in person; the vanguard, by the Duke of York, was posted as a wing on the right; and the rearguard, commanded by Lord Camois, as a wing on the left. The archers were placed between the wings in the form of a wedge, with their poles (long stakes sharpened at each end) fixed before them to defend them from an attack of cavalry, and the flanks were protected by hedges and coppices. Everything being prepared for the contest, Henry rode along his lines, and addressed them with great spirit and effect.

After the armies had remained in the same position for some hours, each waiting the advance of the other, a negotiation was commenced with a view of forming a truce; but the terms proposed by the English king not being acceded to, the venerable Sir Thomas Erpingham, a knight of the garter and a soldier of the highest reputation, was ordered to array the archers, and place them in front, and he exhorted all in Henry's name to fight vigorously; then, riding before the archers, he drew them up, and when this was done he threw his baton into the air, exclaiming, 'Now strike,' which was answered by a loud cry;

after which he dismounted, and placed himself in the king's battalion, who was also on foot, opposite his men, with his banner borne before him. It was now between ten and eleven in the forenoon, and Henry, finding that the greater part of the day had been wasted, and that the French would not approach, but were probably either waiting for reinforcements or expecting to oblige him to surrender for want of provisions, resolved to commence the attack. Having issued the command, 'Banners advance,' the soldiers immediately prostrated themselves to the ground, beseeching the Almighty; and each of them put a small piece of earth into his mouth, in remembrance, as has been conjectured, that they were mortal, and formed of dust. They then marched towards the enemy in three lines, with great firmness and intrepidity, uttering repeated shouts, and with their trumpets sounding.

The constable, on seeing them approach, after earnestly admonishing his men to confess their sins and fight bravely, ordered his advanced guard to march toward the English, which they did, crying, 'Montjoye! Montjoye!' The battle commenced by the English archers shooting their arrows as soon as they were within reach of the enemy, and much execution was done among them before the combatants closed. The French cavalry, posted along the flanks, attacked the archers on each side, but the division commanded by Elignot de Brabant, admiral of France, which consisted of 800 horse, and was intended to break through them, was reduced to about 150, who attempted it in vain, being compelled to retreat from the volleys of arrows. Sir William de Saveuse, with 300 men-at-arms, likewise gallantly endeavoured to accomplish this object, but he was immediately killed; his followers were repulsed by the archers placing their pointed stakes before them, and the horses being infuriated by the wounds from the arrows, became unmanageable, great part of them, with their riders rolling on the earth from pain, whilst the others fled at the utmost speed upon the van, threw it into confusion, and forced it back upon some newly-sown ground. Of this fortunate circumstance Henry took instant advantage, by causing his men to advance upon them with the greatest celerity, at which moment the flanks of both armies immersed into the woods on each side. When the French advance guard, who had boldly marched towards them, under the great disadvantage of having the sun in their eyes, came near, whether from the effect of the heavy discharge of arrows, which pierced through the sides and beaver of their bacinets, or with the view of sooner penetrating the English lines, they suddenly formed themselves into three divisions, and charged with so much impetuosity in three places where the banners stood, that for a short period

the English gave way, but quickly rallying they recovered their ground, and repulsed their assailants with tremendous loss. The conflict was then very severe; they threw aside their bows and fought with overwhelming impetuosity with the swords, bills, lances, and hatchets, with which the field was covered, slaying all before them. A dreadful slaughter consequently took place in the van of the French army, and the assailants speedily reached the second line, which was posted in the rear of the first. For a time the English met with a spirited opposition, but the confusion which produced the defeat of the van now extended to this division, and those immense numbers on which they placed such reliance became the chief cause of their destruction. Standing upon soft ground, and heavily armed, without sufficient room to move, they necessarily impeded each other; and being thus unable to offer any material resistance, they fell victims as much to the unfortunate situation and circumstances in which they were placed as to the valour of their enemies.

When the French lines gave way, the Duke of Alençon mounted his horse, with the hope of rallying the fugitives; but finding it impossible, he returned to the scene of danger, and after performing prodigies of valour, was slain, while in personal combat with the King of England. The rear seeing what had befallen their companions, took to flight, leaving only the chief leaders on the field, and such of them as survived were made prisoners. At that moment great numbers of the French who had been routed, including part of the rearguard, collected as if they intended to renew the conflict, and Henry being informed that they had actually attacked his rear and plundered his baggage, expected that he was to be again engaged—an event which, from the amount of his prisoners, who would of course join their countrymen, he had every cause to fear might prove fatal; imperative necessity consequently dictated what no other circumstances could possibly palliate, and every man was ordered to put his prisoner to death. They refused, however, to obey; and it would be an honourable trait in the character of the conquerors, if the refusal sprang from feelings of honour and humanity, but unfortunately this reluctance is attributed to an unwillingness to lose the benefit of their ransoms, as the greater part were persons of distinction. An esquire and two hundred archers were therefore ordered to perform the horrible office, who obeyed the command in a manner which is described as having been 'a fearful sight to see.' In this shocking massacre few were spared excepting the Dukes of Orleans and Bourbon, and some other illustrious individuals.

The English archers, to whose gallantry and steadiness the victory may be chiefly attributed, wore little armour, but were

habited in jackets, and their hose loose, with hatchets or swords hanging from their girdles, and many were barefooted and without hats, whilst others had caps of thick leather crossed with iron. The battle lasted about three hours; the slaughter on the part of the French was appalling, and cannot be more forcibly described than in the words of one of the chroniclers who witnessed it. 'When some of the enemy's van were slain, those behind pressed over their bodies, so that the living fell over the dead, and others again falling on them, they were immediately put to death: and in three places near Henry's banner, so large was the pile of corpses, and of those who were thrown upon them, that the English stood on the heaps, which exceeded a man's height, and butchered their adversaries below with their swords and axes.' The French indeed fell almost passive in their lines. The total loss of the French was about 10,000 slain on the field—that of the English appears to have been about 1,200: most of the dead were afterwards buried in enormous trenches. Henry being left master of the field, walked over the plain attended by several noblemen, and returned solemn thanks to God for his success. Whilst the soldiers were employed stripping the dead, he called to him Montjoye, the principal herald of France, and asked him whether the victory belonged to him or the King of France: to which Montjoye replied, 'to him.' The king then asked the name of the castle which he saw near him, and being told that it was called Agincourt, 'Then,' said he, 'as all battles should bear the name of the nearest fortress to which they occur, this shall for ever be called the Battle of Agincourt.'

TARE AND TRET.

- (1) What is the cost of 4 hhds. of sugar, No. 1 weighing, gross, 11 cwt. 2 qrs. 14 lbs., tare 3 qrs. 18 lbs.; No. 2, 10 cwt. 2 qrs. 4 lbs., tare 3 qrs. 4 lbs.; No. 3, 12 cwt. 1 qr., tare 3 qrs. 14 lbs.; No. 4, 11 cwt. 10 lbs., tare 3 qrs. 10 lbs.; tret 1 lb. per cwt.; price £20 per ton?
- (2) Gross weight of 7 hhds. of tallow is 5 tons 4 cwt. 2 qrs. 25 lbs., tare 14 lbs. per cwt.; what is the net weight?
- (3) Bought 52 hhds. of tobacco; gross weight 11 tons 2 cwt. 3 qrs. 20 lbs.; tare 25 cwt. 3 qrs.; tret and cloff as usual; what was the weight?
- (4) What must I pay for 7 hhds. of sugar weighing, gross, 47 cwt. 2 qrs. 14 lbs., tret as usual, at 28s. per cwt?
- (5) What will be the cost of 17 boxes, each 1 cwt. 2 qrs. 15 lbs.; tare 3 lbs. per box; tret and cloff as usual; price 75s. per box.

SOAP, SODA, SALT, AND SULPHURIC ACID.

(From 'Letters on Chemistry,' by Professor Liebig.)

cu'-lin-ar-y, used in or relating to cook- ing	quart-a'-tion, mixing in the proportion of one to four
ra'-tio, proportion	gran'-u-la-ted, formed in small pieces or grains
ac'-me, the highest point or crisis	pre-cip'-i-ta-ted, thrown down
fu'-sion, the act of melting	pig'-ment, paint
ox'-y-hy'-dro-gen blowpipe, one in which the flame is fed with a mixture of oxy- gen and hydrogen, and which produces a most intense heat	germ-i-na'-tion, the act of putting forth shoots
re-sid'-u-ar-y, remaining	ma-tu-ra'-tion, ripening
a-mal-ga-ma-tion, the mixing of metals, &c., to form one	ar-te'-ri-al, flowing in the arteries, the vessels which convey blood from the heart
cu'-pel', a sort of shallow cup made of ashes, burnt bones, &c., and used in re- fining metals	blub'-ber, the fat of whales, &c.
	Sam-oy'-edes, a dispersed nation, for- merly inhabiting Tartary. Many now are scattered about the deserts which extend along the north coast of Asia.

THE manufacture of soda from common culinary salt may be regarded as the foundation of the extraordinary impulse given to improvement in every department of modern industry; and we may take it as affording an excellent illustration of the dependence of the various branches of human industry and commerce upon each other, and their relation to chemistry.

Soda, properly carbonate of soda, or rather its chief constituent, the alkali, has been used in France from time immemorial in the manufacture of soap and glass, two chemical productions which employ and keep in circulation an immense amount of capital. The quantity of soap consumed by a nation would be no inaccurate measure whereby to estimate its wealth and civilisation. Political economists, indeed, will not give it this rank; but whether we regard it as joke or earnest, it is not the less true, that, of two countries, with an equal amount of population, we may declare with positive certainty that the wealthier and more highly civilised is that which consumes the greatest weight of soap. This consumption does not subserve sensual gratification, nor depend upon fashion, but upon the feeling of the beauty, comfort, and welfare attendant upon cleanliness; and a regard to this feeling is coincident with wealth and civilisation. The rich, in the middle ages, who concealed a want of cleanliness in their clothes and persons under a profusion of costly scents and essences, were more luxurious than we are in eating and drinking, in apparel and horses. But how great is the difference between their days and our own, when a want of cleanliness is equivalent to insupportable misery and misfortune!

Soap is one of those manufactured products, the money value of which continually disappears from circulation, and requires

to be continually renewed. It is one of the few substances which, like tallow and oil, are entirely consumed by use, leaving no product of any worth. Broken glass and bottles are by no means absolutely worthless; for rags we may purchase new cloth, but soap-water has no value whatever in our households. The attempt has been made, in great washing establishments, to collect the soap-water, and to separate from it the fatty acids of the soap by sulphuric acid. When the fatty acids are heated so as to destroy their impurities, they may be used for an inferior kind of soap. But this restores only a small fraction of what is used in our household economy. It would be interesting to know accurately the amount of capital involved in the manufacture of soap; it is certainly as large as that employed in the coffee trade, with this important difference as respects Germany, that it is entirely derived from our own soil.

In order to prepare the soda of commerce (which is the carbonate) from common salt, it is first converted into Glauber's salt (sulphate of soda). For this purpose 80 pounds weight of concentrated sulphuric acid (oil of vitriol) are required to 100 pounds of common salt. The duty upon salt checked, for a short time, the full advantage of this discovery; but when the British Government repealed the duty, and its price was reduced to its minimum, the cost of soda depended upon that of sulphuric acid.

The demand for sulphuric acid now increased to an immense extent; and, to supply it, capital was embarked abundantly, as it afforded an excellent remuneration. The origin and formation of sulphuric acid was studied most carefully; and from year to year, better, simpler, and cheaper methods for making it were discovered. With every improvement in the mode of manufacture, its price fell, and its sale increased in an equal ratio.

Sulphuric acid is now manufactured in leaden chambers, of such magnitude that they would contain the whole of an ordinary-sized house. As regards the process and the apparatus, this manufacture has reached its acme; scarcely is either susceptible of improvement. The leaden plates of which the chambers are constructed, requiring to be joined together with lead (since tin or solder would be acted on by the acid)—this process was, until lately, as expensive as the plates themselves; but now, by means of the oxyhydrogen blowpipe, the plates are cemented together at their edges by mere fusion, without the intervention of any kind of solder, and so easily that a child might perform the operation.

And then, as to the process: according to theory, 100 pounds weight of sulphur ought to produce 306 pounds of sulphuric

acid; in practice 300 pounds are actually obtained; the amount of loss is therefore too insignificant for consideration. . . .

It is impossible to trace all the ramifications of this tissue of changes and improvements resulting from one chemical manufacture; but I must still claim your attention to a few more of its most important and immediate results. I have already told you, that, in the manufacture of soda from culinary salt, it is first converted into sulphate of soda. In this first part of the process, the action of sulphuric acid produces fuming concentrated muriatic acid to the extent of one-and-a-half times or twice the amount of the sulphuric acid employed. At first, the profit upon the soda was so great, that no one took the trouble to collect the muriatic acid: indeed it had no commercial value. A profitable application of it was, however, soon discovered: it is a compound of chlorine, and this substance may be obtained from it purer and more cheaply than from any other source. The bleaching power of chlorine has long been known; but it was only employed upon a large scale after it was obtained from this residuary muriatic acid, and it was found that in combination with lime it could be transported to distances without inconvenience. Thenceforth it was used for bleaching cotton; and, but for this new bleaching process, it would scarcely have been possible for the cotton manufacture of Great Britain to have attained its present enormous extent,—it could not have competed in price with that of France and Germany. In the old process of bleaching, every piece had to be exposed to the air and light during several weeks in the summer, and kept continually moist by manual labour. For this purpose, meadow land, eligibly situated, was essential. Now, a single establishment near Glasgow, of only moderate extent, bleaches 1,400 pieces of cotton daily throughout the year. What an enormous capital would be required to purchase land for this purpose! How greatly would it increase the cost of bleaching to pay interest upon this capital, or to hire so much land in England! This expense would scarcely have been felt in Germany. Besides the diminished expense, the cotton stuffs bleached with chlorine suffer less in the hands of skilful workmen than those bleached in the sun; and already the peasantry in some parts of Germany have adopted it and find it advantageous.

Another use to which cheap muriatic acid is applied, is the manufacture of glue from bones. Bone contains from 30 to 36 per cent. of earthy matter—chiefly phosphate of lime—and the remainder is gelatine. When bones are digested in muriatic acid they become transparent and flexible, like leather, the earthy matter is dissolved, and after the acid is carefully *washed away*, pieces of glue of the same shape as the bones

remain, which are soluble in hot water, and adapted to all the purposes of ordinary glue, without further preparation.

Another important application of sulphuric acid may be adduced; namely, to the refining of silver and the separation of gold, which is always present in some proportion in native silver. Silver, as it is usually obtained from mines in Europe, contains in 16 ounces, 6 to 8 ounces of copper. When used by the silversmith, or in coining, 16 ounces must contain in Germany 13 ounces of silver, in England about 14½. But this alloy is always made artificially by mixing pure silver with the due proportion of copper; and for this purpose the silver must be obtained pure by the refiner. This he formerly effected by amalgamation, or by cupelling it with lead; and the cost of this process was about 2*l.* for every hundred weight of silver. In the silver so prepared, about $\frac{1}{1000}$ to $\frac{1}{8000}$ th part of gold remained; to effect the separation of this by quartation, with nitric acid, was more expensive than the value of the gold; it was therefore left in utensils, or circulated in coin, valueless. The copper, too, of the native silver was lost to the possessor. But the $\frac{1}{1000}$ th part of gold, being about one and one-half per cent. of the value of the silver, now covers the cost of refining, and affords an adequate profit to the refiner; so that he effects the separation of the copper, and returns to his employer the whole amount of the pure silver, as well as the copper, without demanding any payment; he is amply remunerated by that minute portion of gold. The new process of refining is a most beautiful chemical operation; the granulated metal is boiled in concentrated sulphuric acid, which dissolves both the silver and the copper, leaving the gold nearly pure, in the form of a black powder. The solution is then placed in a leaden vessel containing metallic copper; this is gradually dissolved, and the silver precipitated in a pure metallic state. The sulphate of copper thus formed is also a valuable product, being employed in the manufacture of green and blue pigments.

ANIMAL HEAT.

All living creatures, whose existence depends upon the absorption of oxygen, possess within themselves a source of heat, independent of surrounding objects.

This general truth applies to all animals, and extends to the seed of plants in the act of germination, to flower-buds when developing, and fruits during their maturation.

In the animal body, heat is produced only in those parts to which arterial blood, and with it the oxygen absorbed in respiration, is conveyed. Hair, wool, and feathers receive no arterial blood, and therefore in them no heat is developed. The com-

bination of a combustible substance with oxygen is, under all circumstances, the only source of animal heat. In whatever way carbon may combine with oxygen, the act of combination is accompanied by the disengagement of heat. It is indifferent whether this combination takes place rapidly or slowly, at a high or at a low temperature: the amount of heat liberated is a constant quantity.

The carbon of the food, being converted into carbonic acid within the body, must give out exactly as much heat as if it had been directly burned in oxygen gas or in common air; the only difference is, the production of the heat is diffused over unequal times. In oxygen gas the combustion of carbon is rapid and the heat intense; in atmospheric air it burns slower and for a longer time, the temperature being lower.

It is obvious that the amount of heat liberated must increase or diminish with the quantity of oxygen introduced in equal times by respiration. Those animals, therefore, which respire frequently, and consequently consume much oxygen, possess a higher temperature than others which, with a body of equal size to be heated, take into the system less oxygen. The temperature of a child (102°) is higher than that of an adult (99.5°). That of birds (104° to 105.4°) is higher than that of quadrupeds (98.5° to 100.4°) or than that of fishes or amphibia, whose proper temperature is from 2.7° to 3.6° higher than that of the medium in which they live. All animals, strictly speaking, are warm-blooded; but in those only which possess lungs is the temperature of the body quite independent of the surrounding medium.

The most trustworthy observations prove that in all climates, in the temperate zones as well as at the equator or the poles, the temperature of the body in men, and in what are commonly called warm-blooded animals, is invariably the same; yet how different are the circumstances under which they live! . . .

In the animal body the food is the fuel; with a proper supply of oxygen we obtain the heat given out during the oxidation or combustion of that fuel. In winter, when we take exercise in a cold atmosphere, and when consequently the amount of inspired oxygen increases, the necessity for food containing carbon and hydrogen increases in the same ratio; and by gratifying the appetite thus excited, we obtain the most efficient protection against the most piercing cold. The oxygen taken into the system is given out again in the same form, both in summer and winter. We expire more carbon at a low than at a high temperature, and require more or less *carbon* in our food in the same proportion; and, consequently, *more is respired* in Sweden than in Sicily, and in our own

country an eighth more in winter than in summer. Even if an equal weight of food is consumed in hot and cold climates, Infinite Wisdom has ordained that very unequal proportions of carbon shall be taken in it. The fruits used by the inhabitants of southern climes do not contain, in a fresh state, more than 12 per cent. of carbon, while the blubber and train oil which feed the inhabitants of polar regions contain 66 to 80 per cent. of that element.

From the same cause it is comparatively easy to be temperate in warm climates, or to bear hunger for a long time under the equator; but cold and hunger united very soon produce exhaustion.

A starving man is soon frozen to death. The animals of prey in the Arctic regions, as everyone knows, far exceed in voracity those of the torrid zone.

In cold and temperate climates, the air, which instantly strives to consume the body, urges man to laborious efforts, in order to furnish the means of resistance to its action, while, in hot climates, the necessity of labour to provide food is far less urgent.

Our clothing is merely an equivalent for a certain amount of food. The more warmly we are clothed, the less urgent becomes the appetite for food, because the loss of heat by cooling, and consequently the amount of heat to be supplied by the food, is diminished.

Were we to go naked, like certain savage tribes, or if in hunting or fishing we were exposed to the same degree of cold as the Samoyedes, we should be able with ease to consume half of a calf, and perhaps a dozen of tallow candles into the bargain, daily, as warmly clad travellers have related with astonishment of these people. We should then also be able to take the same quantity of brandy or train oil without bad effects, because the carbon and hydrogen of these substances would only suffice to keep up the equilibrium between the external temperature and that of our bodies.

INSURANCE, COMMISSION, BROKERAGE, ETC.

- (1) What is the commission on £5,000 at 2s. 6d. or $\frac{1}{2}$ per cent. ?
 - (2) What is the brokerage on £11,250 at 7s. 6d. per cent. ?
 - (3) What is the commission on £1,010 at 35s. per cent. ?
 - (4) What is the brokerage on £609 11s. 3½d. at £3 10s. per cent. ?
 - (5) What is the commission on £7,689 10s. at 2s. 6d. per cent. ?
 - (6) What would be the insurance on £63,768 at 3s. 2d. per cent. ?
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SELECTIONS FROM THE POEMS OF PRIOR,
ADDISON, AND POPE.

(Matthew Prior.)

[Born, 1664; died, 1721. Chief Works: 'Solomon,' and Miscellaneous Poems.]

<i>Pro-to'-ge-nēs, a painter of Rhodes, who flourished B.C. 328</i> <i>A-pel'-les, a painter of Cos, who lived at the same time as Protogenes</i> <i>mis'-sive, anything sent as a letter, &c.</i>	<i>ex-pa'-ti-ate, to range at large, to en- large upon</i> <i>un-tu'-tor-ed, untaught</i> <i>pro-pi'-tious, favourable</i> <i>di-late', to spread out, to speak at large</i>
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PROTOGENES AND APELLES.

WHEN poets wrote and painters drew,
 As nature pointed out the view;
 Ere Gothic forms were known in Greece,
 To spoil the well-proportion'd piece;
 And in our verse ere monkish rhymes
 Had jangled their fantastic chimes;
 Ere on the flowery lands of Rhodes,
 Those knights had fixed their dull abodes,
 Who knew not much to paint or write,
 Nor car'd to play, nor dar'd to fight:
 Protogenes, historians note,
 Liv'd there, a burghess, scot and lot;
 And, as old Pliny's writings show,
 Apelles did the same at Co.
 Agreed these points of time and place,
 Proceed we in the present case.
 Piqu'd by Protogenes's fame,
 From Co to Rhodes Apelles came,
 To see a rival and a friend,
 Prepar'd to censure or commend;
 Here to absolve, and there object,
 As art with candour might direct.
 He sails, he lands, he comes, he rings;
 His servants follow with the things:
 Appears the governante of th' house,
 For such in Greece were much in use:
 If young or handsome, yea or no,
 Concerns not me or thee to know.
 Does Squire Protogenes live here?
 Yes, sir, says she, with gracious air
 And curtsy low, but just called out
 By lords peculiarly devout,
 Who came on purpose, sir, to borrow
 Our Venus for the feast to-morrow,

To grace the church, 'tis Venus' day :
 I hope, sir, you intend to stay,
 To see our Venus, 'tis the piece
 The most renown'd throughout all Greece ;
 So like th' original, they say :
 But I have no great skill that way.
 But, sir, at six ('tis now past three)
 Dromo must make my master's tea :
 At six, sir, if you please to come,
 You'll find my master, sir, at home.

Tea, says a critic, big with laughter,
 Was found some twenty ages after ;
 Authors, before they write should read.
 'Tis very true ; but we'll proceed.

And, sir, at present would you please
 To leave your name—Fair maiden, yes.
 Reach me that board. No sooner spoke
 But done. With one judicious stroke,
 On the plain ground Apelles drew
 A circle regularly true :

And will you please, sweetheart, said he,
 To show your master this from me ?

By it he presently will know
 How painters write their names at Co.
 He gave the panel to the maid.

Smiling and curtsying, sir, she said,
 I shall not fail to tell my master :

And, sir, for fear of all disaster,
 I'll keep it my own self: safe bind,
 Says the old proverb, and safe find.
 So, sir, as sure as key or lock—
 Your servant, sir, at six o'clock.

Again at six Apelles came,
 Found the same prating civil dame.
 Sir, that my master has been here,
 Will by the board itself appear.
 If from the perfect line be found
 He has presum'd to swell the round,
 Or colours on the draft to lay,
 'Tis thus (he order'd me to say),
 Thus write the painters of this isle,
 Let those of Co remark the style.

She said, and to his hand restor'd
 The rival pledge, the missive board.
 Upon the happy line were laid
 Such obvious light and easy shade,
 The Paris' apple stood confess'd,

Or Leader's egg, or Chloe's breast.
Apelles view'd the finished piece ;
And live, said he, the arts of Greece !
Howe'er Protogenes and I
May in our rival talents vie ;
Howe'er our works may have express'd
Who truest drew, or colour'd best,
When he beheld my flowing line,
He found at least I could design :
And from his artful round I grant,
That he with perfect skill can paint.

The dullest genius cannot fail
To find the moral of my tale ;
That the distinguish'd part of men
With compass, pencil, sword, or pen,
Should in life's visit leave their name
In characters which may proclaim
That they with ardour strove to raise
At once their arts and country's praise ;
And in their working, took great care
That all was full, and round, and fair.

THE BATTLE OF BLENHEIM.

(*Joseph Addison.*)

[Born, 1672 ; died, 1719. Principal Works : Various Poems, the Tragedy of ' *Cato* ' and his celebrated Essays, which appeared in the ' *Spectator* .']

BUT now the trumpet, terrible from far,
In shriller clangours animates the war ;
Confed'rate drums in fuller concert beat,
And echoing hills the loud alarm repeat :
Gallia's proud standards to Bavaria's join'd,
Unfurl their gilded lilies in the wind ;
The daring prince his blasted hopes renews,
And while the thick embattled host he views
Stretch'd in deep array, and dreadful length,
His heart dilates, and glories in his strength.

The fatal day its mighty course began,
That the griev'd world had long desir'd in vain ;

States that their new captivity bemoan'd,
 Armies of martyrs that in exile groan'd,
 Sighs from the depths of gloomy dungeons heard,
 And prayers, in bitterness of soul preferr'd,
 Europe's loud cries, that Providence assail'd,
 And Anna's ardent vows at length prevail'd;
 The day was come when heav'n design'd to show
 His care and conduct of the world below.

Behold, in awful march and dread array
 The long-extended squadrons shape their way!
 Death, in approaching, terrible, imparts
 An anxious horror to the bravest hearts;
 Yet do their beating breasts demand the strife,
 And thirst of glory quells the love of life.
 No vulgar fears can British minds control;
 Heat of revenge, and noble pride of soul,
 O'erlook the foe, advantag'd by his post,
 Lessen his numbers, and contract his host;
 Though fens and floods possess'd the middle space,
 That unprovok'd they would have fear'd to pass;
 Nor fens nor floods can stop Britannia's bands,
 When her proud foe rang'd on their borders stands.

But oh, my muse, what numbers wilt thou find
 To sing the furious troops in battle join'd!
 Methinks I hear the drums tumultuous sound,
 The victors' shout, and dying groans confound
 The dreadful burst of cannon rend the skies,
 And all the thunder of the battle rise.
 'Twas then great Marlbro's mighty soul was prov'd,
 That, in the shock of charging hosts, unmov'd,
 Amidst confusion, horror, and despair,
 Examin'd all the dreadful scenes of war;
 In peaceful thought the field of death surveyed,
 To fainting squadrons sent the timely aid,
 Inspir'd repuls'd battalions to engage,
 And taught the doubtful battle where to rage.
 So when an angel, by divine command,
 With rising tempests shakes a guilty land,
 Such as of late o'er pale Britannia pass'd,
 Calm and serene he drives the furious blast,
 And, pleas'd th' Almighty's orders to perform,
 Rides in the whirlwind and directs the storm.

The Campaign.

THE PASSION OF HOPE, AND DESIRE FOR HAPPINESS IN MAN.

(*Alexander Pope.*)

[Born, 1688; died, 1744. Principal Works: *Essay on Criticism*, *Rape of the Lock*, *Temple of Fame*, *Elegy on an Unfortunate Lady*, *Windsor Forest*, Translation of Homer's *Iliad*, *Essay on Man*, and the *Dunciad*.]

HOPE springs eternal in the human breast:
Man never is, but always to be, blest,
The soul, uneasy, and confin'd from home,
Rests and expatiates in a life to come.

Lo! the poor Indian, whose untutor'd mind
Sees God in clouds, or hears him in the wind;
His soul proud science never taught to stray
Far as the solar walk or milky way:
Yet simple nature to his hope has given,
Behind the cloud-topped hill, a humbler heaven;
Some safer world in depth of woods embrac'd,
Some happier island in the watery waste,
Where slaves once more their native land behold,
No friends torment, no Christians thirst for gold.
To be, contents his natural desire.
He asks no angel's wing, no seraph's fire;
But thinks, admitted to that equal sky,
His faithful dog shall bear him company.

* * * * *

O Happiness! our being's end and aim,
Good, pleasure, ease, content! whate'er thy name;
That something still which prompts the eternal sigh,
For which we bear to live, or dare to die;
Which, still so near us, yet beyond us lies,
O'erlook'd, seen double, by the fool and wise!
Plant of celestial seed! if dropped below,
Say, in what mortal soil thou deign'st to grow?
Fair opening to some court's propitious shine,
Or deep with diamonds in the flaming mine?
Twin'd with the wreaths Parnassian laurels yield,
Or reaped in iron harvests of the field?
Where grows?—where grows it not? If vain our toil,
We ought to blame the culture, not the soil.
Fixed to no spot is happiness sincere;
'Tis nowhere to be found, or everywhere;
'Tis never to be bought, but always free,
And, fled from monarchs, St. John! dwells with thee.

Ask of the learn'd the way? The learn'd are blind;
 This bids to serve, and that to shun, mankind.
 Some place the bliss in action, some in ease;
 Those call it pleasure,—and contentment these;
 Some, sunk to beasts, find pleasure end in pain;
 Some, swell'd to gods, confess e'en virtue vain;
 Or, indolent, to each extreme they fall,
 To trust in everything, or doubt of all.

Essay on Man.

INSURANCE.

- (1) What must I pay to insure £500 at £1 13s. 4d. per cent.?
- (2) What amount can I insure for £37 10s. at 1½ per cent.?
- (3) What premium must I pay for insuring £2,500 at 2s. 6d. per cent.?
- (4) What is the rate per cent. if it cost me £17 1s. 3d. to insure £750?
- (5) What will be the insurance on £10,000 if I pay for ¼ of the amount at 10s. 6d., ⅓ at 12s. 6d., and the remainder at 15s. per cent.?
- (6) If the government duty on all fire insurance policies were 3s. per cent., how much must be insured to produce a revenue of half a million?

THE LAPPS, AND THE GEYSIRS OF ICELAND.

(From 'Letters from High Latitudes,' by Lord Dufferin.)

hex-ag'-on-al, having six angles
 trail, the track of a beast
 troph'-y, a memorial of a victory
 typ'-i-fy, to represent by an emblem or
 type
 en-dow'-ments, gifts of nature
 res'-tive, unmanageable
 Crc'-sus, an ancient king of Lydia,
 noted for his great riches
 dow'-er-ed, possessing a dowry or mar-
 riage portion

si-mul'-ta'-ne-ous-ly, at the same time
 or'-i-fice, an opening
 con-ge'-ries, a mass of small bodies
 sil'-i-ca, the chief component of flint,
 sand, &c.
 cur'-so-ry, hasty, slight
 func'-tion-ar-y, one who fills any office
 chap'-er-on-age, attendance as a guide
 im'-pro-vised, to make a thing without
 forethought
 in-cip'-i-ent, beginning

In the summer-time they live in canvas tents; during winter, when the snow is on the ground, the forest Lapps build huts in the branches of trees, and so roost like birds. The principal tent is of an hexagonal form with a fire in the centre, whose smoke rises through a hole in the roof. . . Hunting and fishing are the principal employments of the Lapp tribes; and to slay a bear is the most honourable exploit a Lapp hero can achieve. The flesh of the slaughtered beast becomes the property, not of the man who killed him, but of him who discovered his trail, and the skin is hung up on a pole, for the wives of all who took part in the expedition to shoot at with their eyes bandaged. Fortunate is she whose arrow pierces the trophy,—not only does it become her prize, but in the eyes of the whole

settlement her husband is looked upon thenceforth as the most fortunate of men. As long as the chase is going on, the women are not allowed to stir abroad; but as soon as the party have safely brought home their booty, the whole female population issues from the tents, and having deliberately chewed some bark of a species of alder, they spit the red juice into their husbands' faces, typifying thereby the bear's blood which has been shed in the honourable encounter.

Although the forest, the rivers, and the sea supply them in a great measure with their food, it is upon the reindeer that the Laplander is dependent for every other comfort in life. The reindeer is his estate, his horse, his cow, his companion, and his friend. He has twenty-two different names for him. His coat, trowsers, and shoes are made of reindeer's skin, stitched with thread manufactured from the nerves and sinews of the reindeer. Reindeer milk is the most important item in his diet. Out of reindeer horns are made almost all the utensils used in his domestic economy; and it is the reindeer that carries his baggage, and drags his sledge. But the beauty of this animal is by no means on a par with his various moral and physical endowments. His antlers, indeed, are magnificent, branching back to the length of three or four feet; but his body is poor, and his limbs thick and ungainly; neither is his pace quite so rapid as is generally supposed. The Laplanders count distances by the number of horizons they have traversed; and if a reindeer changes the horizon three times during the twenty-four hours, it is thought a good day's work. Moreover, so just an appreciation has the creature of what is due to his great merit, that if his owner seeks to tax him beyond his strength, he not only becomes restive, but sometimes actually turns upon the inconsiderate Jehu who has overdriven him. When, therefore, a Lapp is in a great hurry, instead of taking to his sledge, he puts on a pair of skates exactly twice as long as his own body, and so flies on the wings of the wind.

Every Laplander, however poor, has his dozen or two dozen deer; and the flocks of a Lapp Cresus amount sometimes to two thousand head. As soon as a young lady is born—after having been duly rolled in the snow—she is dowered by her father with a certain number of deer, which are immediately branded with her initials, and thenceforth kept apart as her especial property. In proportion as they increase and multiply does her chance improve of making a good match. Lapp courtships are conducted pretty much in the same fashion as in other parts of the world. The aspirant, as soon as he discovers that he has lost his heart, goes off in search of a friend and a bottle of brandy. The friend enters the tent and opens *simultaneously*—the brandy and his business; while the lover *remains outside*, engaged in hewing wood or some other menial

employment. If after the brandy and the proposal have been duly discussed, the eloquence of his friend prevails, he is himself called into the conclave, and the young people are allowed to rub noses. The bride then accepts from her suitor a present of a reindeer's tongue, and the espousals are considered concluded. The marriage does not take place for two or three years afterwards; and during the interval the intended is obliged to labour in the service of his father-in-law, as diligently as Jacob served Laban for the sake of his long-loved Rachel.

THE GEYSIRS.

I do not know that I can give you a better notion of the appearance of the place than by saying that it looked as if—for about a quarter of a mile—the ground had been honeycombed by disease into numerous sores and orifices; not a blade of grass grew on its hot, inflamed surface, which consisted of unwholesome looking red livid clay, or crumpled shreds and shards of slough-like incrustations. Naturally enough, our first impulse on dismounting was to scamper off at once to the Great Geysir. As it lay at the farthest end of the congeries of hot springs, in order to reach it we had to run the gauntlet of all the pools of boiling water and scalding quagmires of soft clay that intervened, and consequently arrived on the spot with our ankles nicely poulticed. But the occasion justified our eagerness. A smooth silicious basin, seventy-two feet in diameter, and four feet deep, with a hole at the bottom as in a washing-basin on board a steamer, stood before us brimful of water just upon the simmer; while up into the air above our heads rose a great column of vapour, looking as if it was going to turn into the Fisherman's Genie. The ground about the brim was composed of layers of incrustated silica, like the outside of an oyster, sloping gently down on all sides from the edge of the basin.

Having satisfied our curiosity with this cursory inspection of what we had come so far to see, hunger compelled us to look about with great anxiety for the cook; and you may fancy our delight at seeing that functionary in the very act of dishing up dinner on a neighbouring hillock. Sent forward at an early hour, under the chaperonage of a guide, he had arrived about two hours before us, and seizing with a general's eye the key of the position, at once turned an idle babbling little Geysir into a camp-kettle, dug a bakehouse in the hot soft clay, and improvising a kitchen-range at a neighbouring vent, had made himself completely master of the situation. It was about one o'clock in the morning when we sat down to dinner, and as light as day. As the baggage-train with our tents and beds had not yet arrived, we fully appreciated our luck in being treated to so

dry a night; and having eaten everything we could lay hands on, were set quietly down to chess, and coffee brewed in Geysir water; when suddenly it seemed as if beneath our very feet a quantity of subterranean cannon were going off; the whole earth shook, and Sigurdr, starting to his feet, upset the chess-board (I was just beginning to get the best of the game), and flung off full speed toward the great basin. By the time we reached its brim, however, the noise had ceased, and all we could see was a slight movement in the centre, as if an angel had passed by and troubled the water. Irritated at this false alarm, we determined to revenge ourselves by going and tormenting the strokr. Strokr—or *the churn*—you must know, is an unfortunate Geysir, with so little command over his temper and his stomach, that you can get a *rise* out of him whenever you like. All that is necessary is to collect a quantity of soda, and throw them down his funnel. As he has no basin to protect him from these liberties, you can approach to the very edge of the pipe, about five feet in diameter, and look down at the boiling water which is perpetually seething at the bottom. In a few minutes the dose of turf you have just administered begins to disagree with him; he works himself up into an awful passion; tormented by the qualms of incipient sickness, he groans and hisses, and boils up, and spits at you with malicious vehemence, until at last, with a roar of mingled pain and rage, he throws up into the air a column of water forty feet high, which carries with it all the sods that have been chucked in, and scatters them scalded and half-digested at your feet.

So irritated has the poor thing's stomach become by the discipline it has undergone, that even long after all foreign matter has been thrown off, it goes on retching and sputtering, until at last nature is exhausted, when, sobbing and sighing to itself, it sinks back into the bottom of its den.

STOCKS AND SHARES.

- (1) What must I pay for £3,750 in the 3 per cent. consols, if I buy at $98\frac{1}{2}$?
- (2) How much stock at 76 can I purchase for £5,000?
- (3) How many shares of £100 in the New Zealand Bank can be purchased for £10,000, when they are at a premium of £15?
- (4) What sum, invested in the 3 per cents. at $85\frac{1}{2}$, will produce an income of £150 per annum?
- (5) If I invest £8,000 in the following manner, viz. one-half in the $3\frac{1}{4}$ per cents. at $90\frac{1}{2}$, two-fifths in the 3 per cents. at 87, and the remainder in 4 per cents. at 95, what income shall I annually derive from my investments?
- (6) What will be the brokerage on the above investments at $\frac{1}{8}$ per cent. on the amount of stock purchased?

WOLSEY AND THE CLERGY IMMEDIATELY BEFORE THE REFORMATION.

(From the 'History of England,' by J. A. Froude, M.A.)

in-cip'i-ent, *beginning*
a-bey'-ance, *not in possession or active*
exercise

le'-gate, *a Pope's ambassador*
trans-i'tion, *change from one place or*
state to another

mor-tu-a-ry, *a burialplace, a gift left to*
the church

fa-vor'-em hæ-ret'-i-cæ pra'-vi-ta-tis
(Lat.), *the favour of an heretical de-*
pravity

stat'-ute of pro-vi'-sors, *an act passed in*

the reign of Edward III. rendering it
penal to receive appointments to bene-
fices from the Court of Rome

præ-mu-ni'-re, *an act passed in the reign*
of Richard II. (1393), making it un-
lawful for anyone to bring into the
kingdom bulls, excommunications, &c.,
from the Court of Rome. The offence
against which this was directed was
called a 'præmunire.'

po-lem'-ic, *controversial, relating to a*
discussion

[The celebrated Cardinal Wolsey, son of an Ipswich butcher, who had risen to the highest offices in Church and State, attempted a reform in discipline without touching on doctrine or the jurisdiction of the Pope. He was eventually driven from power, in consequence of the refusal of the latter to grant the divorce between Henry VIII. and Catharine of Arragon. The King then declared the Church of England independent of that of Rome: and thus was commenced the Reformation, which was not completed, however, until the succeeding reign of Edward VI.]

HENRY VII. sat too insecurely on his throne to venture on a resolute reform,* even if his feelings had inclined him towards it, which they did not. Morton durst not resolutely grapple with the evil. He rebuked and remonstrated; but punishment would have caused a public scandal. He would not invite the inspection of the laity into a disease which, without their assistance, he had not the strength to encounter; and his incipient reformation died away ineffectually in words. The Church, to outward appearance, stood more securely than ever. The obnoxious statutes of the Plantagenets were in abeyance—their very existence, as it seemed, was forgotten; and Thomas à Becket never desired more absolute independence for the ecclesiastical order than Archbishop Warham found established when he succeeded to the primacy. He, too, ventured to repeat the experiment of his predecessor. In 1511 he attempted a second visitation of the monasteries, and again exhorted a reform; but his efforts were even slighter than Morton's, and in their results equally without fruit. The maintenance of his order in its political supremacy was of greater moment to him than its moral purity: a decent veil was cast over the clerical infirmities, and their vices were forgotten as soon as they ceased to be proclaimed. Henry VIII., a mere boy on his accession, was borne away with the prevailing stream; and, trained from

* An Act had been passed by the first Parliament of Henry VII. for the punishment of 'priests, clerks, and religious men' who should be guilty of crimes; and Cardinal Morton procured authority from the Pope to visit the religious houses, 'the abominations of which had become notorious,' 1488.

his childhood by theologians, he entered upon his reign saturated with theological prepossessions. The intensity of his nature recognising no half-measures, he was prepared to make them the law of his life; and so zealous was he, that it seemed as if the Church had found in him a new Alfred or Charlemagne. Unfortunately for the Church, institutions may be restored in theory, but theory, be it never so perfect, will not give them back their life; and Henry discovered, at length, that the Church of the sixteenth century as little resembled the Church of the eleventh, as Leo X. resembled Hildebrand, or Warham resembled St. Anselm.

If, however, there were no longer saints among the clergy, there could still arise among them a remarkable man; and in Cardinal Wolsey the king found an adviser who was able to retain him longer than would otherwise have been possible in the course which he had entered upon; who, holding a middle place between an English statesman and a Catholic of the old order, was essentially a transition minister; and who was qualified, above all men then living, by a combination of talent, honesty, and arrogance, to open questions which could not again be closed when they had escaped the grasp of their originator. Under Wolsey's influence, Henry made war with Louis of France in the Pope's quarrel, entered the polemic lists with Luther, and persecuted the English Protestants. But Wolsey could not blind himself to the true condition of the Church. He was too wise to be deceived with outward prosperity; he knew well that there lay before it, in Europe and at home, the alternative of ruin and amendment; and therefore he familiarised Henry with the sense that a reformation was inevitable; and dreaming that it could be effected from within, by the Church itself inspired with a wiser spirit, he himself fell the first victim of a convulsion which he had assisted to create, and which he attempted too late to stay.

His intended measures were approaching maturity, when all Europe was startled by the news that Rome had been stormed by the Imperial army, — that the Pope was imprisoned, the churches pillaged, the cardinals insulted, and all-holiest things polluted and profaned. A spectator, judging only by outward symptoms, would have seen at that strange crisis in Charles V. the worst patron of heresy, and the most dangerous enemy of the Holy See; while the indignation with which the news of these outrages was received at the English Court would have taught him to look upon Henry as the one sovereign in Europe on whom that see might calculate most surely for support in its hour of danger. If he could have pierced below the surface, he would have found that the Pope's best friend was the prince who held him prisoner; that Henry was but doubtfully acquiescing in the policy of an unpopular mi-

nister; and that the English nation would have looked on with stoical resignation if Pope and Papacy had been wrecked together. They were not inclined to heresy; but the ecclesiastical system was not the Catholic faith; and this system, ruined by prosperity, was fast pressing its excesses to the extreme limit beyond which it could not be endured. Wolsey talked of reformation, but delayed its coming; and in the meantime the persons to be reformed showed no fear that it would come at all. The monasteries grew worse and worse. The people were taught only what they could teach themselves. The consistory courts became more oppressive. Pluralities multiplied, and non-residence and profligacy. Favour'd parish clergy held as many as eight benefices. Bishops accumulated sees, and, unable to attend to all, attended to none. Wolsey himself, the church-reformer (so little did he really know what a reformation meant), was at once Archbishop of York, Bishop of Winchester, of Bath, and of Durham, and Abbot of St. Albans. In Latimer's opinion, even twenty years later, and after no little reform in such matters, there was but one bishop in all England for ever at his work and ever in his diocese. 'I would ask a strange question,' he said, in an audacious sermon at St. Paul's Cross, 'Who is the most diligent bishop and prelate in all England, that passeth all the rest in doing of his office? I can tell, for I know who it is; I know him well. But now I think I see you listening and hearkening that I should name him. There is one that passeth all the others, and is the most diligent prelate and preacher in all England. And will ye know who it is? I will tell you. It is the devil! Among all the pack of them that have cure, the devil shall go for my money, for he applieth his businesses. Therefore, ye unpreaching prelates, learn of the devil to be diligent in your office. If ye will not learn of God, for shame learn of the devil!'

Under such circumstances, we need not be surprised to find the clergy sunk low in the respect of the English people. Sternly intolerant of each other's faults, the laity were not likely to be indulgent to the vices of men who ought to have set an example of purity; and from time to time, during the first quarter of the century, there were explosions of temper which might have served as a warning, if any sense or judgment had been left to profit by it.

In 1514 a London merchant was committed to the Lollard's Tower for refusing to submit to an unjust exaction of mortuary,* and a few days after was found dead in his cell. An inquest was held upon the body, when a verdict of wilful murder was returned against the Chancellor of the Bishop of

* A peculiarly hateful form of clerical impost, the priests claiming the black dress worn in life by persons brought to them for burial.

London; and so intense was the feeling of the city, that the Bishop applied to Wolsey for a special jury to be chosen on the trial: 'for assured I am,' he said, 'that if my chancellor be tried by any twelve men in London, they may be so maliciously set in *favorem hereticæ pravitatis*, that they will cast and condemn any clerk, though he were as innocent as Abel.' . . .

Symptoms such as these boded ill for a self-reform of the Church, and it was further imperilled by the difficulty which it is not easy to believe that Wolsey had forgotten. No measures would be of efficacy which spared the religious houses, and they would be equally useless unless the bishops, as well as the inferior clergy, were comprehended in the scheme of amendment. But neither with monks nor bishops could Wolsey interfere except by a permission from the Pope, and the laws were unrepealed which forbade English subjects, under the severest penalties, to accept or exercise within the realm an authority which they had received from the Holy See. Morton had gone beyond the limits of the Statute of Provisors in receiving powers from Pope Innocent to visit the monasteries: but Morton had stopped short with inquiry and admonition. Wolsey, who was in earnest with the work, had desired and obtained a full commission as legate, but he could only make use of it at his peril. He was exposing, not himself only, but all persons, lay and clerical, who might recognise his legacy * to a *præmunire*; and he knew well that Henry's connivance or even expressed permission could not avail him if his conduct was challenged. He could not venture to appeal to parliament. Parliament was the last authority whose jurisdiction a churchman would acknowledge in the concerns of the clergy; and his projects must sooner or later have sunk, like those of his two predecessors, under its own internal difficulties, even if the accident † had not arisen which brought the dispute to a special issue in its most vital point, and which, fostered by Wolsey for his own purposes, precipitated his ruin.

MISCELLANEOUS EXERCISES ON PERCENTAGE.

- (1) If a man buys goods for £3200 and sells them for £5000, what does he gain per cent.?
- (2) If I purchase silk at 5s. per yard and sell it at a profit of 20 per cent., what quantity must I dispose of to gain £100?
- (3) A collector who receives $2\frac{1}{2}$ per cent. commission earns £300 per annum; how much does he collect?
- (4) By selling 1000 yards of cloth a draper gains £15 12s. 6d.; his profits being $12\frac{1}{2}$ per cent., what was the prime cost of the cloth per yard?
- (5) If a tradesman's average profits are 20 per cent. on his outlay, what is his net income when his returns are £4560 per annum?

* The office of a Legate.

† The King's divorce.

WATER.

(From 'Lectures on Food,' by Dr. Lankester.)

ce'-re-al, relating to corn
 nu'-tri-tive, having the quality of nourish-
 ing
 com-stit'-u-ents, the parts of which a
 compound is formed
 oc'-u-lar, relating to the eye
 sa-line', consisting of salt
 a-nal'-y-sis, the separation of a compound
 into its constituents

le-gu'-mi-nous, relating to peas, beans,
 &c.
 sa-li'-va, spittle
 con-tam'-i-na-ted, defiled, corrupted
 or-gan'-ic, consisting of organs
 de-mon-s-tra'-tion, certain proof
 phys-i-ol'-o-gist, one versed in the science
 which treats of the functions of plants
 and animals

WATER, in many respects, more closely resembles nutritive food than it does heat-giving food; that is to say, it more closely approaches, in its relation to the human system, the character of flesh than it does the character of starch or sugar; and for this reason, that it combines with the tissues of the body, and forms a necessary part of its structure.

I have made a calculation that a human body weighing 154 lbs. contains 111 lbs. of water. You see, then, how necessary water is. If you reduce the size of the man, you reduce the quantity of water; and you will find that water enters into the composition of all our food.

Before speaking more particularly of water, I will call your attention, in the first place, to its composition; it is not my province to dwell on the elementary composition of food any further than it throws a light on its action. Water, then, is composed of two gases, one called oxygen, and another called hydrogen; and we can easily decompose water so as to demonstrate its composition. If you take a piece of potassium—which is a metal so malleable that you can cut it with a knife—and put it into water, it has such an affinity for the oxygen of the water, that, when combined with it, it inflames. On putting it into water, the metal actually appears to take fire, and is converted into common potash. The hydrogen gas of the water is liberated, and it is this gas which burns during the decomposition of the water. This is a beautiful chemical experiment, and demonstrates the composition of water. But there are many other ways of doing this. If we take a little alcohol, or anything which contains hydrogen, and burn it in atmospheric air, under a glass vessel, we shall find that we produce water; so that we can easily by household experiments demonstrate the composition of water.

I now come to speak of water in relation to the life of plants and animals. Both animals and plants require it; and no animal, and no plant, exists without certain quantities of water. Sometimes it is so large in quantity that it constitutes the great

mass of the animal or plant. Thus, if we take some plants that grow in water, we find that they are formed of from 90 to 95 per cent. of water; and many of the little animals contained in water, if we take them and expose them to heat, so as to evaporate their water, almost entirely disappear. Even solid timber contains as much as 30 per cent. of water. Plants will not live without water: if we refrain from watering them, they die. The water passes in at their roots, and up their stems and into their leaves, and the sun dries them, and evaporates their moisture. The water taken up by plants contains their food,—carbonic acid gas and ammonia. These two substances pass into the plant with the water, and out of these things we have manufactured in the system of the plant all our vegetable food. Carbonic acid gas, ammonia, and water, then, are the food of plants. They contain the four elements—carbon, oxygen, hydrogen, and nitrogen; and of these the food of man principally consists.

I told you just now that a human body weighing 154 lbs. contains 111 lbs. of water; but there are some animals in the lower scale which contain larger quantities than this. Thus Professor Owen tells us he took a jelly fish, and found it weighed 2 lbs., and when dried in the sun its solid parts weighed only 16 grains; so that you see there were 2 lbs. of water organised by 16 grains of solid matter. If we examine the tissues of animals, we shall find that they contain large quantities of water. This water, which is contained in animals, just the same as in plants, is constantly liable to evaporation. If you take a piece of blotting-paper, and roll it up, and put one end in water, you will find the water will be gradually drawn up, and get into the dry end, which you may cut into strips, so as to resemble the expanded leaves of a plant. In this way water finds its way to the leaves and flowers of plants, and the heat of the atmosphere causes the water to evaporate from the expanded surface of the plant, in the same way as in the blotting paper: the mass is constantly losing its moisture, and water must therefore be supplied.

Water is contained in our solid food, and we thus get it entirely independent of our supplying it in a liquid form. . . .

Now I will draw your attention to the great importance of understanding the fact that certain forms of solid food contain but very little water, and that other forms contain a great deal. Thus, for instance, those who live chiefly on potatoes, as the Irish peasantry, require but very little water in their ordinary diet. A very curious fact illustrative of this took place during the famine in Ireland in 1847. It was all at once discovered *that Ireland, in the midst of her famine, was beginning to consume a larger quantity of what might be regarded as the*

luxuries of diet, such as sugar, tea, coffee, chocolate, and the like. The explanation is this—When the potatoes became diseased, the peasantry ate corn, maize, Indian meal, and rice in their place, and therefore lost a quantity of water, to which they had been accustomed in their potatoes; and then it was they took tea and coffee, to which they had not been accustomed before; and there can be no doubt these were consumed in larger quantities for the purpose of supplying the necessary water to the system. . . .

The quantity of water in a pound of potatoes is about twelve ounces, and this is not got rid of by cooking. Let us now look at the quantity in rice: instead of having twelve ounces, as in the potato, you have but two ounces and an eighth. There is barley, which contains but two ounces of water in sixteen of barley; and in beans there are but two ounces of water to the pound. With regard to the other cereal and leguminous foods, they have very much the same quantity of water. But there are the cabbage, the parsnip, the turnip, and the carrot, with larger quantities of water than the potato; thus accounting for the comparative inutility of carrots, cabbages, and potatoes, as compared with beans, peas, and other materials with which animals are fed. Then with regard to the beverages which we take, such as tea and coffee, we find that the greater portion is water. Even with regard to beer, taking table beer—which, by the bye, is much the best for ordinary drinking—it contains not more than half an ounce of alcohol in a pint, and the rest is water; while the strong pale ales and stout contain two ounces of alcohol, the rest being water. Taking the French wines, very few of them contain more than two ounces of alcohol in a pint of twenty ounces. Even our ports and sherries, brandied as they are, contain as much as twelve or fourteen ounces of water in the pint.

Now, the action of water in our food is very important. There would be no carrying of food into the system but for the agency of water. It dissolves everything that we take; and nothing that we take as food can become nutriment that is not dissolved in water. It would not do to test that by taking things and putting them into water, and seeing whether they dissolve, and rejecting them as food according to that circumstance; because food undergoes a considerable change in the stomach. It undergoes a change, to begin with, in our mouth. One of the great objects of that change is to render things soluble which had been before insoluble in water. Starch, which cannot dissolve in water out of the stomach, is dissolved in water directly it gets into the mouth, for the starch is changed by the saliva into sugar, and that which would lie unchanged in water for months, is so changed by the saliva of the mouth and the *gastric juice of the stomach*, that it is speedily dissolved. Ther

where we are taking considerable quantities of dry food, it becomes absolutely necessary that we should add a certain quantity of water, so that this dry food should become dissolved. Such things as oats, barley, wheat, rice, maize, and other articles of diet containing little water, must have water added, in order that their starch, fat, and gluten may be dissolved and enter into the system.

Having indicated the necessity of water, let me call your attention to the sources of water as drunk ordinarily for the purposes of diet. People are generally very indifferent about water; and perhaps it arises from the fact that boiling it before we make tea or beer makes us independent of the impurities of water in its natural condition. At the same time, I do not think it wise to be dependent for the water needed by the system on beverages containing a variety of foreign ingredients; and for this reason—that the water gets its soluble powers interfered with by having things in solution. Thus a pint of beer will not dissolve so much of the starch or digested meat as water. So with regard to the food which is digesting; it is sometimes better that we should pour upon it cold pure water than hot water containing a variety of substances in solution. I am not advocating the giving up of tea, coffee, beer, or wine, but the necessity of taking a portion of the water we daily consume as pure as it can be had.

Now, there are many sources of water. The first great source is the ocean, which collects all the water from the earth; and this water contains so large a quantity of salt, that none of us can drink it. The shining sun, however, bears down upon the ocean's surface, and its heating rays penetrating the water, combine, as it were, with it, and raise it up. The atmosphere, like a sponge, absorbs the vaporous water, carrying it from the equator to the Arctic and the Antarctic regions; thus distributing it north and south. It then condenses in the form of rain and of snow, when, sinking into the earth and pouring down its mountain sides, it forms springs and rivulets, entering the ocean again in the form of rivers; and now man catches it in tubs or cisterns, in its progress in the rivers, or digs down into the earth, and catches it as it passes along beneath his feet. Thus we have rain water, river water, and spring or well water.

I need not dwell on sea water; but it is a very interesting fact to know, that by a process invented by my ingenious friend Dr. Normandy, sea water may be distilled and rendered perfectly pure and fit for human use.

With regard to rain water, there is no doubt that it is one of the purest waters that we have, arising from the fact that it is *the first condensed water* after it has passed from the ocean into *the atmosphere*; but its use is liable to the objection that, where

it runs down the sides of houses into cisterns, it passes through an atmosphere frequently contaminated with sulphurous acid and ammonia, and the unconsumed carbon of chimneys, of which we have so constantly unpleasant reminders in large towns. Still, where rain water can be collected in the open country, there is no doubt that it is the purest form of water. It is, however, on spring and river water that we are more dependent; and to the spring and well waters I would more especially call your attention.

There are two kinds of well waters, or spring waters, which are consumed in London, as well as most other parts of the world; and those are the surface-well waters, and the deep-well waters. In London we dig down deep into the chalk, and get water from below the London clay; this is deep-well water. . . . London is, in fact, situated in a basin of chalk. Above the chalk is a deposit, varying in thickness, branching off to the side of the basin, as you see, of London clay: above this clay is a layer of gravel. Now, the water, passing through or under this gravel, gradually accumulates on the clay, so that if you dig 20 or 25 feet in any of the gravelly districts of London, you get plenty of water—this is called surface-well water: but, if you want to get pure water, you must dig deeper than the clay; you must go through the clay down to the chalk. Wells dug down to the chalk are called Artesian wells. I shall have to speak of these waters again when I speak of the constituents of water; but I may just say here, that persons suppose it is a matter of indifference whether they obtain their water from surface-wells or from deep-wells. This, however, is not the fact; for, although surface-well water is frequently clearer, cooler, and more sparkling than deep-well water, it is always liable to suspicion.

The sparkling of these waters arises from the carbonic acid gas they contain; and in nine cases out of ten that carbonic acid is derived from the decomposition of animal and vegetable matters. Their cooling taste is no less indicative of their impure origin, as it arises from the formation of salts, which could only occur from the decomposition of organic matter.

The situation of these wells, especially in London, explains the origin of these impure matters. The water that supplies the surface-wells of London is derived from the rain which falls upon the surface of the land, and which percolates through the gravel, and accumulates upon the clay. Now, this gravel contains all the soakage of London filth; through it run all the drains and sewers of London, and its whole surface is riddled with innumerable cesspools. Here is the source of the organic matter of surface-well waters, and also the cause of their coolness, their sparkling, and their popularity. In most small towns there is a public pump, and, when this is near the

churchyard, it is said to be always popular. The character of the water is no doubt owing to the same causes as that of London surface-wells—the remains of humanity in the churchyard supply the nitrates and carbonic acid of the water.

From this kind of impurity the water of deep wells in London, and of wells cut into rocks which bring their water from a distance from towns, are entirely free. They frequently contain inorganic salts in abundance, but they do not contain organic matters; hence, for drinking purposes, they are very preferable to the waters of surface-wells. A great number of these wells exist in London. There is one attached to almost every brewery in London, and other manufacturers, who need pure water for their operations, sink these wells.

If you require ocular demonstration of the impurity of surface-well water, let me draw your attention to a series of these waters in the South Kensington Museum, where you will observe that the effect of time and exposure upon the surface-well water has been to organise their dissolved organic matters, and the bottles exhibit a variety of forms of plants which have been thus developed.

Then we come to river water. The great distinguishing feature of river water is, that, being exposed to the air, it becomes the medium of life to both plants and animals. We have not only fish, and snails, and reeds and pond-weeds growing in river water, but we have innumerable forms of microscopic animals and plants. Even after this water is filtered, and supplied to towns, as in the case of the Thames to London, these microscopic creations abound.

There is also another source of impurity in river water; our lands and farms are highly manured, and the water passing over them carries the constituents of the manure to the river; and the river waters are to that extent objectionable.

I will now draw your attention generally to the contents of these waters, and endeavour to show you the action of what are called their 'impurities.' I do not know that it is correct to say that all saline matter is an impurity; our own blood contains 420 grains of saline matter in a gallon. Now if a physiologist were to say this was an impurity in the blood, he would be laughed at for his assertion. If water contains saline matters, it is the necessity of the thing, and, in small quantities, these impurities have never been proved to do any harm. By analysis, however, we can come to the conclusion whether these things are in quantities likely to be injurious. We may have more saline matter in the blood than 420 grains to the gallon; then it would be an impurity. We must therefore recollect how this word *impurity* is used. There are two kinds of substances in *water* which are generally called impurities—the first consists

of saline substances, as common salt, carbonate of soda, and sulphate of lime; these are called saline impurities. Sometimes these saline substances are found in so large quantities as to render the waters medicinal, as in the waters of Cheltenham, Leamington, Harrowgate, and many other places. Such waters are called 'mineral.' They are remarkable for the permanence of their constituents, and many of them have been known in this country to possess the same constituents for hundreds of years. The most generally useful of these waters are those which contain iron, and are called 'chalybeate,' as the waters of Harrowgate and Tunbridge Wells. Some of these contain larger quantities of sulphuretted hydrogen than our foulest sewer-waters, and yet are drunk medicinally; such are the waters of Askern, Harrowgate, Moffat, and Gillesland. That these waters may be drunk with impunity, should be a hint to those who imagine that sulphuretted hydrogen is in itself a dangerous gas. The fact is, it is not so; and in drains and sewers, and decomposing animal and vegetable compounds, it is not the cause of danger, but a sign of danger. The springs of Epsom are charged with sulphate of magnesia; hence we call this substance Epsom salts. Other substances, more or less injurious in their action upon the human system, are contained in mineral springs, and are prescribed according to the special need of those who seek their aid as medicines.

SIMPLE INTEREST.

- (1) What is the interest on £750 for one year at 5 per cent.?
 - (2) What is the interest on £8379 16s. 8d. for 16 years at 4 per cent.?
 - (3) In what time will £100 double itself at 4 per cent. per annum, simple interest?
 - (4) What is the rate of interest when £150 amounts to £164 12s. 6d. in 3 years?
 - (5) Find the interest on £6566 18s. 6d. for 8 years at $9\frac{3}{4}$ per cent. per annum.
 - (6) What is the interest on £587 10s. 6d. for 3 years at £4 17s. 6d. per cent. per annum?
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MANNERS IN NEW YORK IN THE DUTCH TIMES.

(From the 'History of New York,' by Washington Irving.)

[Washington Irving, a popular American prose writer, who wrote under the name of Diedrich Knickerbocker, was born at New York in 1783. His chief works are: 'History of New York,' 'The Sketch Book,' 'Bracebridge Hall,' 'Tales of a Traveller,' &c. Died, 1859.]

de'-si-gna-ted, *named, called*
 Jē'-o-lus, *son of Jupiter and god of the wind*
 burn'-ish, *to polish metal*
 in-un-da'-tion, *an overflowing of water*
 am-phib'-i-ous, *living on land or in water*
 sanc-tum sanc-to'-rum (Lat.), *holy of holies*
 rhom'-boid, *a four-sided figure whose opposite sides only are equal and parallel, and whose angles are not right angles*
 burgh'-er, *a townsman*

in-con-test'-a-ble, *that cannot be contradicted*
 de-lect'-a-ble, *delightful*
 or'-gies, *noisy feasts*
 jun'-to, *a number of persons united in a plot; a cabal*
 dul'-cet, *sweet to the taste or ear*
 syl'-la-bub, *a mixture of warm new milk with wine, sugar, &c.*
 beaux, plural of beau (Fr.), *well-dressed young men*
 a-droit'-ness, *cleverness, nimbleness*
 pig'-my, *a dwarf*
 de-mure'-ly, *quietly, bashfully*

THE houses of the higher class were generally constructed of wood, excepting the gable end, which was of small black and yellow Dutch bricks, and always faced on the street; as our ancestors, like their descendants, were very much given to outward show, and were noted for putting the best leg foremost. The house was always furnished with abundance of large doors and small windows on every floor; the date of its erection was curiously designated by iron figures on the front; and on the top of the roof was perched a fierce little weathercock, to let the family into the important secret which way the wind blew. These, like the weathercocks on the tops of our steeples, pointed so many different ways, that every man could have a wind to his mind; and you would have thought old Æolus had set all his bags of wind adrift, pell-mell, to gambol about this windy metropolis: the most staunch and loyal citizens, however, always went according to the weathercock on the top of the governor's house, which was certainly the most correct, as he had a trusty servant employed every morning to climb up and point it whichever way the wind blew.

In those good days of simplicity and sunshine, a passion for cleanliness was the leading principle in domestic economy, and the universal test of an able housewife; a character which formed the utmost ambition of our unenlightened grandmothers. The front door was never opened except on marriages, funerals, new year's days, the Festival of St. Nicholas, or some such great occasion. It was ornamented with a gorgeous brass knocker, curiously wrought, sometimes into the device of a dog,

and sometimes of a lion's head, and was daily burnished with such religious zeal that it was oftentimes worn out by the very precautions taken for its preservation. The whole house was constantly in a state of inundation, under the discipline of mops, and brooms, and scrubbing-brushes; and the good housewives of those days were a kind of amphibious animal, delighting exceedingly to be dabbling in water, insomuch that a historian of the day gravely tells us, that many of his townswomen grew to have webbed fingers like unto a duck, and some of them, he had little doubt, could the matter be examined into, would be found to have the tails of mermaids; but this I look upon to be a mere sport of fancy, or, what is worse, a wilful misrepresentation.

The grand parlour was the sanctum sanctorum, where the passion for cleaning was indulged without control. In this sacred apartment no one was permitted to enter excepting the mistress and her confidential maid, who visited it once a week for the purpose of giving it a thorough cleaning, and putting things to rights, always taking the precaution of leaving their shoes at the door, and entering devoutly in their stocking feet. After scrubbing the floor, sprinkling it with fine white sand, which was curiously stroked into angles, and curves, and rhomboids, with a broom, after washing the windows, rubbing and polishing the furniture, and putting a new bunch of evergreens in the fireplace, the window shutters were again closed to keep out the flies, and the room carefully locked up until the revolution of time brought round the weekly cleaning day.

As to the family, they always entered in at the gate, and most generally lived in the kitchen. To have seen a numerous household assembled around the fire, one would have imagined that he was transported back to those happy days of primeval simplicity which float before our imaginations like golden visions. The fireplaces were of a truly patriarchal magnitude, where the whole family, old and young, master and servant, black and white, nay, even the very cat and dog, enjoyed a community of privilege, and had each a prescriptive right to a corner. Here the old burgher would sit in perfect silence, puffing his pipe, looking in the fire with half-shut eyes, and thinking of nothing for hours together; the *goede vrouw* on the opposite side would employ herself diligently in spinning her yarn or knitting stockings. The young folks would crowd around the hearth, listening with breathless attention to some old crone of a negro who was the oracle of the family, and who, perched like a raven in a corner of the chimney, would croak forth for a long winter afternoon a string of incredible stories about New England witches, grisly ghosts, horses without

heads, and hairbreadth escapes and bloody encounters among the Indians.

In those happy days a well-regulated family rose with the dawn, dined at eleven, and went to bed at sundown. Dinner was invariably a private meal, and the fat old burghers showed incontestable symptoms of disapprobation and uneasiness at being surprised by a visit from a neighbour on such occasions. But though our worthy ancestors were thus singularly averse to giving dinners, yet they kept up the social bonds of intimacy by occasional banquetings, called tea-parties.

As this is the first introduction of those delectable orgies, which have since become so fashionable in this city, I am conscious my fair readers will be very curious to receive information on the subject. Sorry am I that there will be but little in my description calculated to excite their admiration. I can neither delight them with accounts of suffocating crowds, nor brilliant drawing-rooms, nor towering feathers, nor sparkling diamonds, nor immeasurable trains. I can detail no choice anecdotes of scandal, for in those primitive times the simple folk were either too stupid or too good-natured to pull each other's character to pieces; nor can I furnish any whimsical anecdotes of brag; how one lady cheated, or another bounced into a passion; for as yet there was no junto of dulcet old dowagers who met to win each other's money and lose their own tempers at a card-table. These fashionable parties were generally confined to the higher classes, or noblesse—that is to say, such as kept their own cows and drove their own wagons. The company commonly assembled at three o'clock, and went away about six, unless it was in winter-time, when the fashionable hours were a little earlier, that the ladies might get home before dark. I do not find that they ever treated their company to iced creams, jellies, or syllabubs, or regaled them with musty almonds, mouldy raisins, or sour oranges, as is often done in the present age of refinement. Our ancestors were fond of more sturdy and substantial fare. The tea-table was crowned with a huge earthen dish well stored with slices of fat pork, fried brown, cut up into morsels, and swimming in gravy. The company being seated around the genial board, and each furnished with a fork, evinced their dexterity in launching at the fattest pieces of this mighty dish, in much the same manner as sailors harpoon porpoises at sea, or our Indians spear salmon in the lakes. Sometimes the table was graced with immense apple-pies, or saucers full of preserved peaches and pears; but it was always sure to boast of an enormous dish of balls of sweetened dough fried in hog's fat, and called dough-nuts, or oly-kocks, a delicious kind of cake, at present scarce known in this city, excepting in genuine Dutch families.

The tea was served out of a majestic delft tea-pot, ornamented with paintings of fat little Dutch shepherds and shepherdesses, tending pigs—with boats sailing in the air, and houses built in the clouds, and sundry other ingenious Dutch fantasies. The beaux distinguished themselves by their adroitness in replenishing this pot from a huge copper tea-kettle, which would have made the pigmy macaronies of these degenerate days sweat merely to look at it. To sweeten the beverage, a lump of sugar was laid beside each cup, and the company alternately nibbled and sipped with great decorum, until an improvement was introduced by a shrewd and economic old lady, which was, to suspend a large lump directly over the tea-table by a string from the ceiling, so that it could be swung from mouth to mouth—an ingenious expedient, which is still kept up by some families in Albany, but which prevails, without exception, in Communipaw, Bergen, Flat Bush, and all our uncontaminated Dutch villages.

At these primitive tea-parties the utmost propriety and dignity of deportment prevailed. No flirting nor coquetting—no gambling of old ladies, nor hoyden chattering and romping of young ones—no self-satisfied struttings of wealthy gentlemen with their brains in their pockets, nor amusing conceits and monkey divertissements of smart young gentlemen with no brains at all. On the contrary, the young ladies seated themselves demurely in their rush-bottomed chairs, and knit their own woollen stockings, nor ever opened their lips excepting to say *yah Mynheer* or *yah ya Vrouw* to any question that was asked them, behaving in all things like decent well-educated damsels. As to the gentlemen, each of them tranquilly smoked his pipe, and seemed lost in contemplation of the blue and white tiles with which the fireplaces were decorated, wherein sundry passages of Scripture were piously portrayed. Tobit and his dog figured to great advantage; Haman swung conspicuously on his gibbet; and Jonah appeared most manfully bouncing out of the whale, like Harlequin through a barrel of fire.

The parties broke up without noise and without confusion. They were carried home by their own carriages—that is to say, by the vehicles nature had provided them, excepting such of the wealthy as could afford to keep a wagon. The gentlemen gallantly attended their fair ones to their respective abodes, and took leave of them with a hearty snack at the door; which, as it was an established piece of etiquette, done in perfect simplicity and honesty of heart, occasioned no scandal at that time, nor should it at the present; if our great-grandfathers approved of the custom, it would argue a great want of reverence in their descendants to say a word against it.

SIMPLE INTEREST.

- (1) Find the interest on £635 17s. 6d. for 8 years 9 months at $3\frac{1}{2}$ per cent. per annum.
- (2) What will £830 amount to in 5 years 3 months at 4 per cent. per annum?
- (3) What will the half-yearly dividend on £7500 in the 3 per cents. amount to?
- (4) What principal must be invested to produce £350 per annum at 5 per cent.?
- (5) If my half-yearly dividend in the $3\frac{1}{2}$ per cents. is £142 3s. 9d., what amount of that stock do I hold?
- (6) In what time will £520 amount to £1000 at 5 per cent.?
- (7) What principal must I invest at $2\frac{1}{2}$ per cent. to produce £100 per annum?

DISTRIBUTION OF THUNDER-STORMS, HURRICANES, AND EARTHQUAKES.

(From 'Physical Geography,' by Sir John Herschel.)

con-dense' (v.), to make thicker or closer
 per an-num (Lat.), by the year, an-
 nually
 me-te-or-ol'-o-gy, the science of meteors
 par-a-bol'-ic, relating to the section of a
 cone
 vi-cin'-i-ty, neighbourhood
 ge-o-lo'-gi-cal, relating to geology, the
 science which treats of the earth's struc-
 ture
 al-lu'-vi-al, deposited by a flood
 mon-soon', a tropical wind occurring at

certain periods, and continuing for a
 certain time
 arc'-tic, relating to the north pole
 ant-arc'-tic, relating to the south pole
 fo'-cus, plu. foci (Lat.), a point where
 rays of light meet; a point of conver-
 gence
 os-cil-la-to-ry, moving backward and
 forward
 con-ter'-mi-nous, bordering upon
 im-mu'-ni-ty, privilege, freedom

THE explanation of these phenomena, as physical facts, belongs to the departments of meteorology and geology as bodies of science. Their distribution and greater or less intensity and frequency in different regions of the earth, with reference to the local conditions and peculiarities on which these depend, however, form part of our present subject. As electricity is accumulated during the evaporation, and discharged in lightning during the rapid and copious condensation of moisture, we should expect to find thunder-storms most frequent in those regions where, owing to any general or special cause, the condensation of vapour is frequent and sudden; and least so where moisture is most copiously and continually abstracted from the surface by evaporation, with but little return in rain. And such is the case; for it is observed that in those parts of the ocean over which the trade-winds sweep, thunder-storms are

very unfrequent, while in the zone of the equatorial rains from 4° to 9° North latitude, where the first and most copious discharge of the up-cast vapour takes place, and where the clouds form rapidly, and hurry to their resolution at regular hours of the day in rain, electric discharges are exceedingly frequent and violent. So also the setting in of the rainy monsoon, in the monsoon countries, is ushered in with violent thunder-storms, and so in certain localities where, during certain seasons, and at regular hours of the day, clouds collect and rain falls copiously (as in the mountainous parts of Jamaica, and in certain valleys leading off from the Lake of Como, in Italy), thunder-storms occur daily during the hottest season.

In the Polar regions, both arctic and antarctic, thunder-storms are of very rare occurrence; a sufficiently copious supply and sudden condensation of vapour being wanting. M. Geisecke, who resided six years in Greenland, only heard thunder once. Thunder-storms, too, are unknown in the rainless districts of Peru and in California, under the lee of the coast ranges of mountains, which, at the same time that they condense the clouds, attract and carry off the atmospheric electricity. Generally speaking, they are more frequent on mountains than on plains. About forty per annum are reckoned to occur in Greece and Italy, and about twenty-four on the coasts of the Atlantic and in Germany. In the United States they are more frequent and fatal than in Europe.

Violent gales of wind, amounting to what may be called hurricanes, occur pretty generally everywhere except on the equatorial seas; but in the Steppes in the interior of Asia, and in the Siberian plains at the foot of the Altai, as well as among those and the Tangnou mountains, as described by Mr. Atkinson, they appear to be singularly frequent and furious. The true hurricane, cyclone, or typhoon, however, is restricted to very special regions, and its production (as explained in Meteorology) is the result of conditions requiring the ascent of locally-heated columns of air or vapour, with a free in-draft from all sides. Accordingly they are limited at sea to those situations where (under the necessary conditions as to latitude) currents of heated water exist. Where (as in the Gulf Stream) the current is limited in breadth by a well-defined boundary, within which the water is very much warmer than the sea on either side, they follow, with what may well be called considerable precision, the general course of the current: describing parabolic curves in their progress, having the island of Bermuda for their focus. In the Indian and China seas they appear in the neighbourhood of the warm currents; but these currents being much more diffuse and ill-defined than in the case of the Gulf Stream, the region over which they

prevail is correspondingly ill-defined; and in the China sea this is still more markedly the case, though bearing a very obvious relation to the warm water currents skirting the east coasts of Asia.

Earthquakes, of course, habitually infest countries adjacent to active volcanoes, such as Sicily and Calabria in Europe, and the neighbourhood of the Andes in South America, where they are stated by Humboldt to be so frequent that their occurrence, unless severe, is no more regarded than that of a shower in Europe. Java, Sumatra, Japan, and the islands of the Eastern Archipelago, are also exceedingly subject to such visitations. But, besides these, there are districts which, for geological reasons less apparent, being out of the vicinity of any active volcanic vent, are infested with frequent earthquakes. They may, however, be for the most part traced for an origin to mountain chains in which either unequivocal evidence of long extinct, and therefore possibly still dormant, volcanic power can be adduced, or which stand out as grand original axes of upheaval. Thus the whole of Upper India, and a large portion of Western India, from the Himalayas to the mouth of the Indus, is very liable to earthquakes, evidently referable to the Himalayan range as an axis of emanation, and proving clearly that the forces which originally upheaved these mountain masses are still active, though their energy may perhaps be expended in maintaining them at their present elevation. Between 1800 and 1842, no less than 162 earthquakes have been recorded in these districts. In 1843, 23 were observed, and since that time 4 or 5 annually. In the peninsula of India they seldom occur below 15° N. latitude.

Traceable to the neighbourhood of volcanoes not quite extinct, or which, within historic times, have shown signs of activity, we find Greece, Turkey, Asia Minor, Syria, and Palestine, with the district adjacent to Elbruz and the Caspian Sea and the Caucasus, noticeable as earthquake regions. Antioch was the centre of one of the most terrible and destructive earthquakes on record in A.D. 526, and Syria was visited no longer ago than 1837 with an earthquake extending over 4,000 or 5,000 square miles of country.

The south-eastern districts of North America, along the ranges of the Appalachian and Alleghany Mountains, are liable to frequent earthquakes. More than a hundred have been noticed in the last two centuries, which, to judge from the direction habitually taken by their oscillatory motion, would seem to owe their origin to some deep-seated centre of action beneath the line of the great Mexican volcanoes. By one of the more recent of these, the whole valley of the Lower Missis-

sippi was violently agitated, and its levels permanently altered. Lastly, quite beyond all reference to any reasonably distant source of volcanic power, we find a district of very limited extent in the county of Perth, near Comrie, in Scotland, where a year seldom passes without a shock, though never severe enough to do any material damage.* In the Cape districts of South Africa, too, still more remote from any such centre of action, slight shocks are far from unfrequent. Generally speaking, what may be called the earthquake belt of Europe is conterminous, or nearly so, with the zone of newer igneous formation and extinct volcanoes.

On the other hand, vast regions, chiefly extensive alluvial plains, or the low districts which extend out to great distances from the principal mountain chains, enjoy an immunity from earthquake shocks, as, for instance, America east of the Andes, and the great plains on the north-east of Europe and the north of Asia. Where historical evidence is deficient, we have often proof, from the continued upright position of ancient monuments, both natural and artificial, of the absence of at least any great earthquake since their erection, or since their attaining their present form, and that, too, in situations where such complete exemption could hardly have been expected. Thus in Mexico, on the Mimbres River, near El Paso on the Rio Grande, we find described and figured by Bartlett, rocks, which could not possibly have resisted even a very inconsiderable shock. On the west coast of Greenland (much of which is of volcanic origin) the same conclusion may be drawn from the existence of a remarkable slender pillar of rock 200 feet in height, figured by Dr. Kane under the name of Tennyson's Monument. An ancient column in the country bordering on the Indus, said to have been erected by Alexander the Great as the landmark of his Indian conquests, has been in like manner appealed to in favour of an exceptional degree of stability in its site in a region generally much subject to agitation. Pompey's Pillar affords similar evidence for Egypt during the last eighteen centuries, though its prostrate obelisks testify no less distinctly to earlier concussions. The Pierre Botte, in the Isle of Mauritius, offers a similar testimony. From the immense weight and singularly slender support of the block on its summit (perched on a pillar of rock 1,500 feet above the sea), it must have been precipitated by a very moderate shock given to its base.

* In 1860 a shock of an earthquake was felt in several places in Kent, sufficiently powerful to set bells ringing, and to throw down loose articles in dwelling-houses.

SIMPLE INTEREST.

- (1) What is the interest on £125 8s. 9d. for 8 months at 6 per cent.?
- (2) What is the interest on £840 for 10 months at 3 per cent.?
- (3) What is the interest on £115 5s. for 220 days at 4 per cent.?
- (4) Find the interest on £500 for 26 weeks 5 days at 4 per cent.
- (5) What is the interest on £362 12s. 9d. from July 7th to Nov. 28th following at 5 per cent.?
- (6) What is the interest on £1,000 at $4\frac{1}{2}$ per cent. for 21 weeks 3 days?
- (7) What will £5,250 amount to at 6 per cent. from October 5th to January 31st following?

THE SOCIAL CONDITION OF THE PEOPLE

DURING THE REIGN OF ELIZABETH—1558 TO 1603.

(From 'The Kings of England'.)

par-a-pher-na'-li-a, *apparel, ornaments*
 in-flex'-i-ble, *unbending, firm*
 ob'-lo-quy, *blame, slander*
 an-ni-hi-la'-tion, *the act of destroying*
 vogue, *fashion*
 su-per-sede', *to set above, to set aside*

gen-u-flex'-ions, *the act of bending the knee*
 e-vap'-o-rate, *to pass off in vapour*
 con-fla-gra'-tion, *a general fire*
 gro-tesque, *whimsical, ludicrous*

THE manners of the people still continued coarse and barbarous, as we may learn from their amusements. Besides pitching the bar, shooting the broad arrow, playing at racket, quoits, nine holes, and leaping hedges and ditches, their most favourite diversions were baiting different animals. Hentzner, after describing the baiting of bulls and bears, adds—'To this entertainment there follows that of whipping a blinded bear, which is performed by five or six men, standing circularly with whips, which they exercise on him without mercy, as he cannot escape from them, because of his chain. He defends himself with all his force and skill, throwing down those that come within his reach, and are not active enough to get out of it; and tearing their whips out of their hands, and breaking them. At this spectacle and everywhere else,' he adds, 'the English are constantly smoking tobacco.' A more harmless but not more rational recreation is recorded by the same writer. They are 'vastly fond of great noises that fill the ear, such as the firing of cannons, drums, &c., so that it is common for a number of them that have got a glass in their heads, to go up some belfry, and ring the bells for hours together for the sake of exercise.' The queen was equally attached to noise and uproar. She used to listen, during her meals, 'to twelve trumpets and

two kettle-drums, which, together with fifes, cornets, and side-drums, made the hall ring for half an hour together.'

Jousting in the lists, pageants and shows, hunting, hawking, &c., formed the chief diversions of the more polished ranks in society. Plays were just getting into vogue, and regular dramatic pieces had superseded the mysteries and moralities founded on Scripture subjects. The earliest patent for acting comedies, tragedies, &c., is dated 1574; and such was the rapid progress of this rational amusement, that, early in the next century, at least fifteen licensed theatres were open to the inhabitants of London. The best plays, especially those of Shakespeare, were acted chiefly at the Blackfriars Theatre, or at the Globe, on the south side of the Thames. A flag was hoisted on the front of each theatre; the price of admission to the best place a shilling, to the inferior ones a penny or two-pence. The critics sat on the stage, and were furnished with pipes and tobacco. The curtain drew not up, but was drawn back on each side. From the raillery of Sir Philip Sydney, it is doubtful whether there was a change of scenes. It is probable this deficiency was supplied by the names of places being written in large characters on the stage; stating, for instance, that this was a wood, a garden, Thebes, Rome, or Alexandria, as the case might be. The stage was lighted with branches like those hung in churches. Before the exhibition began, three flourishes, soundings, of pieces of music were played, and music was likewise played between the acts. The instruments chiefly used were trumpets, cornets, and hautboys. Perukes and masques formed part of the stage paraphernalia; and the female parts, for the first hundred years, were performed by young men. One dramatic piece composed the whole entertainment, and the hours of acting began about one in the afternoon, and lasted generally about two hours. The audience before the performance began amused themselves with reading and playing at cards; others drank ale or smoked tobacco. For some time plays were acted on Sundays only; after 1579, they were acted on Sundays and other days indiscriminately.

Such was the state of the stage at the commencement of the seventeenth century; having for its foes the Puritans, a race of men stern, inflexible, and unforgiving, it flourished with difficulty, and by increasing obloquy and reproach was first pursued into unpopularity, and at length to annihilation. It did not revive until the Restoration, when Charles II. licensed two companies, Killigrew's and Sir William Davenant's.

Luxury in dress made great progress. The pocket-handkerchiefs of the ladies were frequently wrought with gold and silver, and their shifts were richly embroidered. The *chopine* is sometimes mentioned; it was an Italian shoe, with a heel

ridiculously high. The fly-cap was in great vogue. Aldermen's wives had bonnets of velvet, large and showy; chains and bracelets were ornaments used mostly by women of rank. The ruffs made of lawn and cambric, stiffened with yellow starch, were immoderately large; the poking of these gracefully behind was considered to be a most important attainment. The waist became enormously long, the bodice or stays finished with a most extended point in front at bottom; and to render the appearance still more inconvenient and grotesque, the upper part of the gown, near the shoulders, was considerably enlarged by wool and other stuffing. The fardingdale, a Spanish petticoat, bulky over the hips, now went out of fashion; it was introduced by Philip and Mary. Heywoode thus humorously sings the death of the fardingdale:—

Alas! poor vardingales must lie i' th' streets;
To house them no doore i' th' citee's made meete,
Syns at our narrow doores they cannot go in,
Send them to Oxforde at Brode-gate to get in.

When Paul Hentzner saw Elizabeth, then in her 67th year, she had in her ears two pearls with very rich drops. She wore false hair, and that was red; her bosom was uncovered, 'as all the English ladies,' says Hentzner, 'have till they marry.' She was dressed in white silk, bordered with pearls of the size of beans; and over it a mantle of black silk, shot with silver threads, and instead of a chain, she had an oblong collar of gold and jewels. The same writer adds, that wherever she turned her face, every one fell down upon his knees. Henry VIII. had been treated with similar servility. Petitions were presented to her as she went along, which as she received graciously, the people cried out 'God save Queen Elizabeth,' to which she answered: 'I thancke ye, my goode people.' The presence chamber was strewed with hay; and Hentzner gives a particular account of the tastings, and genuflexions made on entering the queen's room, though her majesty was not present.

Needles and pins were now in common use; the making of the former was commenced in 1556 by Gröuse, a German. Pins were known in Henry VIII.'s reign, and afforded the ladies a convenient substitute for ribbons, loop-holes, tags, clasps, and skewers made of wood, brass, silver and gold. The introduction of silk and worsted hose was a great improvement. Mrs. Montague, Elizabeth's silk-woman, in her third year, presented her majesty a pair of black knit silk stockings, which pleased the queen so much, that she never afterwards wore cloth hose. Soon after, Thomas Burdet, an ingenious apprentice, living opposite St. Magnus' Church, presented Lord Pembroke a pair of worsted stockings, the first knit in this country.

The beard was on the wane in this reign. In the reign of Mary it thrived luxuriantly; those of Bishop Gardiner and Cardinal Pole in their portraits are represented as of an uncommon size; it gradually dwindled down into the mustachios or whiskers. The hair was cut close on the top of the head, and grew long on the sides. Showy young men wore jewels in the ears, and sometimes ribbons. The hat had superseded the woollen cap and hood: the crown of the hat was made high, narrowed towards the top, and had sometimes a rich hatband, adorned with goldsmith's work and precious stones, which, with a feather and scarlet cloak, marked the man of distinction.

Coaches or *caroches* are both mentioned as being in use. They were first introduced by the Earl of Arundel: before that time the queen, on public occasions, rode behind her chamberlain. The novelty and convenience of the plan soon brought them into general practice by people of fortune. Hackney coaches were not known till fifty years afterwards. Spoons and knives were as old as Edward the Confessor; but the fork was not yet discovered, and at every meal the fingers were used to keep the meat steady, and convey it to the mouth. Tablecloths were made of very valuable linen. Mr. Otter, in Ben Jonson's 'Silent Woman,' mentions a damask tablecloth which cost eighteen pounds; the good man of the house sat at the upper end of the board 'with a fayre napkyn layde before him on the table, *lyke a master*.'

Among the customs of the sixteenth century, it must not be omitted to mention that of smoking, or as it was then called, *taking tobacco*. It was first introduced into Europe by the Spaniards, and reached England in 1586, imported by Sir Walter Raleigh's settlers in Virginia. Sir Walter himself was one of its first admirers, but preserved great secrecy in his attachment. Owing to a ridiculous accident the foible was discovered, and it then became general. Sir Walter, as the story is related, was enjoying his pipe in solitude, forgetful that he had ordered his servant to attend him with a goblet of ale. The faithful domestic suddenly entering his study, and finding, as he thought, his master's brains on fire, and evaporating in smoke and flame through his nostrils, did his utmost to extinguish the conflagration, by emptying the goblet on Sir Walter's head. When, many years after, the gallant knight's fate drew near, he smoked two pipes publicly on the scaffold. Stowe, a few years after the introduction of tobacco, wrote of it; he calls it that '*stinking weed*,' and says it was commonly used by most men and many women.

The style of living had much improved. Lamb, and a great variety of delicate meats, mark the luxury of Elizabeth's reign. There were several courses, and every dish had its appropriate

sauce. Beef began to be deemed too gross; brawn, however, was a favourite. A dessert of fruit, spices, and jellies was not unusual. Breakfast was little liked. If anything was taken it was a glass of ale and a slice of bread. Rural life may be learned from Tasser's 'Pointes of Husbandrie.' The farmer and family's diet is fixed to be red herrings and salt fish in Lent, and at other times fresh beef, pork, &c. At Christmas 'good drinke, a good fire in the hall, brawne, pudding, and souse, and mustard withal, capon, turkey, cheese, apples, nuts, with jolie gamboles.' The prudent housewife is advised to make her own candles, servants are directed to go to bed at ten in the summer and nine in the winter, and to rise at five in winter and four in summer. The holidays throughout the year are appointed for working men. The gayest of these festivals seems to have been the wake-day or vigil of the parish saint, 'when every wanton maie danse at her wille.' The hour of dinner with people of fortune was eleven before noon, and of supper between five and six in the afternoon; while the merchants took each of their meals an hour later, and the husbandman one hour later than the merchant. Thus the fashion is entirely changed; the opulent and leisure classes taking their meals later than the industrious orders. Why the meals became later as the times became more refined, is a curious fact. The chief cause seems to be, as Hume intimates, that in rude ages men have few amusements or occupation, but what daylight allows; whereas in ages of refinement, reading, study, and conversation afford employment which can as conveniently be pursued in the night as the day.

SIMPLE INTEREST.

- (1) Find the interest on £852 for 6 weeks 4 days at $2\frac{1}{2}$ per cent. per annum.
 - (2) What is the interest on £376 14s. 8d. for 3 years 34 weeks 2 days at $2\frac{1}{4}$ per cent.?
 - (3) What will £859 13s. amount to in 6 years 60 days at $2\frac{1}{2}$ per cent.?
 - (4) What is the interest on £9,864 17s. 9d. for 10 years 7 weeks 4 days at £4 7s. 6d. per cent.?
 - (5) Required the amount of £498 10s. for 3 years 6 weeks 4 days at $2\frac{1}{2}$ per cent.
 - (6) What sum must I invest to produce £6 13s. 8½d. in 8 weeks 5 days at 5 per cent.?
 - (7) How long must £140 10s. be at interest at 5 per cent. to produce £1 9s. 3d.?
-

AIR.

(From the 'Museum of Science and Art,' by Dr. Lardner.)

os-oil-la'-tion, a moving backward and forward, vibration	in-teg'-u-ment, anything that covers or envelops another
ve-lo'-ci-ty, swiftness, speed	de-vas-ta'-tion, ruin, desolation
prop-a-ga'-ted, spread	mo'-bile, that may be easily moved
stra'-tum, plu. stra'-ta (Lat.), a bed, a layer	vas'-cu-lar, consisting of vessels
at-ten'-u-ate, to make thin or slender	di-late', to enlarge, to widen

Of all common things, air is the most common. No space or place is accessible to us that is not filled with it. It is of all material wants that which is most incessantly indispensable to our existence. Food is an occasional want; an intermitting supply is all that is needed. Clothing may in certain cases be dispensed with, and habit may inure us to a deficiency of it. The want of warmth must be extreme to become fatal. But the privation of air, even for a brief interval, is attended with instant and certain death. Unlike other natural wants, our consumption of air is not voluntary. The action of the lungs is like the oscillations of a pendulum. It is incessant: sleeping or waking, in sickness or in health; sitting, standing, or moving, it is maintained with a regularity and continuity quite independent of the will. Its suspension is the suspension of life. Must we not then be prompted by a natural and irresistible curiosity to obtain some acquaintance with a physical agent so universal, so omnipresent, and so indispensable to our vitality? Air is the transparent, colourless, invisible, light, and attenuated fluid with which we are always surrounded. It is drawn into our lungs by the action called suction, and after remaining a moment there, is forced out through the mouth and nose by the muscular compression of the chest. This alternate action, by which the air enters and leaves the lungs, is called respiration. During the moment it remains in the lungs, it undergoes a certain change, which we shall presently explain, in consequence of which, when expired, it is not the same as that which was inspired. The effect produced on the blood by this change is essential to the maintenance of life.

The air which, thus changed, is expired, is unfit for respiration. If, therefore, the same air be taken several times successively into the lungs, death must ensue.

The air around us, therefore, requires to be continually changed, that which we expire being carried away and replaced by fresh and pure air. The apparent lightness of air, the freedom with which we move through it, and its invisibility,

led the ancients to imagine that it was unsubstantial and immaterial, and hence the disembodied souls of the dead came to be called *spirits*, from the word *spiritus*, which signifies *air*.

It is a great mistake, however, to imagine that air is destitute of weight, that quality which is inseparable from whatever is material. Light it undoubtedly is, but only by comparison. Bulk for bulk it is lighter than stone, earth, or water, or any other substance in the solid or liquid state. But light as it is, it has a certain definite weight, and a quantity of it can be assigned which will weigh many tons. The pressure produced by its weight is under certain assignable circumstances quite enormous, and when it is moved with a certain velocity its force is so irresistible that trees are torn by it from their roots, the most solid buildings overturned and reduced to ruins, and devastation spread over vast tracts of country.

When it is considered that the mass of air which taken collectively is called the atmosphere, extends above us to the height of more than fifty miles, it will easily be imagined that the weight with which it presses on the surface of every object exposed to it must be very considerable. If, for example, we take a square inch of level surface, it is clear that that square inch must bear the weight of a column of air extending from the surface to the top of the atmosphere. It has been ascertained by experiments, susceptible of the greatest precision, that this pressure or weight amounts to about 15 lbs., and that it is subject, from time to time, to a variation not exceeding three-quarters of a pound.

It is a well-known property of fluids, that any pressure which they exert acts equally in all possible directions. Thus, if any body be let down into the sea, the weight of the water which is above it will press equally on its top, bottom, and sides. It is very easy to demonstrate this by a simple experiment.

Let several empty bottles be carefully corked, and being loaded with weights so as to sink in the water, the neck of one being presented upwards, that of another downwards, another horizontal, and the others oblique in various degrees, it will be found that when they have sunk to a certain depth, the corks will be all forced into the bottles by the pressure of the surrounding water, with which the bottles will be immediately filled, and this will take place equally, and at the same time, with all the bottles, in whatever direction the corks may be presented to the water.

It is evident, therefore, that the pressure produced by the *weight of the incumbent column of water at any given depth is equally propagated in all directions*, and that a body, a fish

for example, or body of a diver, sustains that pressure, not downwards only, or on the upper surface of the body, as might be at first imagined, but equally on the under surface, the sides, and, in a word, on every part of the body in contact with the water.

Now, this equal transmission or propagation of pressure in all directions is not an exclusive property of water, but is common to all substances whatever in the fluid state. Air possesses fluidity in even a greater degree, if possible, than water, being more freely mobile, and air accordingly transmits freely and without diminution in all directions whatever any pressure which it receives. The stratum of air in which we live is under the pressure, as it has just been stated, of the incumbent column of air extending upwards to the limits of the atmosphere, this pressure amounting to 15 lbs. on each square inch. A body, therefore, exposed to the contact of this air is subject at all parts of its surface, upper, under, and lateral, to this pressure; and the total amount of the pressure by which it is affected will be expressed in pounds weight by the number obtained by multiplying the number of square inches in its entire surface by 15.

The body of a man of average size has a surface of about 2,000 square inches. The total pressure which it sustains from the surrounding air is therefore $15 \times 2,000$, or 30,000 lbs., or nearly fourteen tons!

It may seem wonderful that a force so enormous, acting on all parts of the surface of the body, should not crush it and actually destroy its delicately constructed organs. This, however, is prevented by the perfect equilibrium of pressure outwards and inwards, produced by the property of fluids just explained, in virtue of which they transmit freely, and undiminished, the pressure in all directions. The fluids which fill the entire vascular system are exposed, as well as the surface of the body, to the pressure of the atmosphere, which enters the lungs and all the cavities and open parts of the organs; these fluids transmit that pressure to all the inner parts of the body, so that the skin and integuments are pressed by them outwards by a force exactly equal to that with which the air presses the external surface of the skin inwards. These outward and inward pressures are necessarily always equal, because, in fact, they are one and the same pressure, i.e., that of the air, the pressure on the external surface acting inwards, being the immediate action of the air, and the pressure of the internal fluids acting outwards, being the same pressure of the air transmitted by those fluids to the inside of the skin and integuments.

That this outward pressure, transmitted by the fluids which fill the organs under the skin, is really at all times in operation,

and that it is only counteracted by the immediate pressure of the external air upon the skin, is rendered conspicuously manifest in the well-known surgical operation of cupping. In that process the open mouth of the cupping-glass being pressed upon the skin so as to exclude all communication with the external air, the air within the cup is withdrawn, or partially withdrawn, by means of a syringe attached to the glass. The moment the skin within the glass is relieved from even a small part of the pressure of the external air by this means, the outward pressure of the fluids under the skin begins to take effect, being no longer resisted; it swells up the skin within the glass, and when the skin thus dilated is punctured with the lancet, the blood is propelled from it by the force of the pressure of the fluids under the skin acting outwards.

Air has another characteristic and highly important quality called elasticity, which, like its compressibility, is unlimited and uniform.

The capability of swelling without limit into augmented dimensions when relieved from the conditions which confine it is called elasticity. Like compressibility, it is a characteristic property in which no other form of matter participates. Liquids are for all practical purposes inelastic. Some solid bodies possess a certain elasticity, but not at all identical in its character or laws with the elasticity of air above described.

* Air in its natural and usual state has an elastic force of 15 lbs. per square inch, so that when it is shut up in any vessel or other envelope, and cut off from all communication with the external air, it will press on every square inch of the inner surface of such envelope with a force of 15 lbs. The stratum of air which rests on the surface of the earth, and in which the organised tribes that inhabit the earth live, derives its pressure, elasticity, and density from the weight of the whole mass of the atmosphere which rests upon it. It must, therefore, be evident that if we ascend to greater elevations, leaving below us a certain stratum of the atmosphere, and having above us a proportionally less quantity of air, the weight of the incumbent air being less, the pressure, elasticity, and density of the stratum which surrounds us will be proportionally less. And we find this actually to be the case. At great heights on mountain chains, such as the Pyrenees or the Alps, the air is very sensibly rarefied. It is lighter, and exercises a much less pressure. In like manner, persons who ascend to great elevations in balloons find much inconvenience from the thinness of the air. The fluids confined within the body are much less resisted, certain organs

become dilated, and the effect of a cupping-glass is occasionally produced, attended with bleeding at the nose and singing in the ears.

The ancients imagined that air was a simple substance which entered more or less into the composition of bodies in general, and hence they called it one of the elements—the others being, in their theory of physics, water, earth, and fire. Better informed now, we know that neither air, water, nor earth, are simple or elementary substances, and that fire is not a substance at all, but a physical effect due to the sudden and large production of heat which attends the chemical combination of certain substances. Thus the ancient elements are not elements at all.

Air—meaning by that term the air of the atmosphere, the air we breathe, the air through which we behold the firmament, the air whose currents carry our commerce over the ocean from land to land—is a compound or mixture made up of two extremely different kinds of air.

As there are many sorts of air having extremely different qualities and properties, although they are alike in appearance, being all invisible, transparent, colourless, light, compressible, and elastic, it has been found convenient to call them by the general name *gas* (derived from the Saxon word *gast*), and to limit the application of the term 'air' to that particular compound or mixture of gases which constitutes the atmosphere.

The erroneous notion that air was a simple and elementary substance prevailed until the close of the last century, when Lavoisier, the celebrated French philosopher, who was one of the most illustrious of the founders of modern chemistry, showed that it was a mixture of two different gases in definite proportions, called oxygen, and azote or nitrogen. A hundred cubic inches of air is a mixture consisting of 80 cubic inches of azote, and 20 of oxygen. The result of the most exact analyses differs from this proportion by a minute fraction, which, though not unimportant in certain respects, need not here embarrass the reader, who will do well to fix in his memory this proportion of 80 to 20.

COMPOUND INTEREST.

- (1) What is the compound interest on £97 for $3\frac{1}{2}$ years at 4 per cent. half-yearly?
- (2) What is the compound interest on £450 for 3 years at 6 per cent.?
- (3) What will £500 amount to in 5 years at 5 per cent., compound interest?
- (4) What is the compound interest on £100 for 6 years at 5 per cent.?
- (5) What will £54 amount to in 4 years at £2 10s. per cent. per half-year?

SELECTIONS FROM THE POEMS OF THOMSON,
COLLINS, AND AKENSIDE.

SHOWERS IN SPRING.

(James Thomson.)

[Born, 1700; died, 1748. Chief works: 'The Seasons,' 'Castle of Indolence,' and some tragedies.]

et-fu'-sive, *pouring out*
dis-tent', *stretched*
lapse (n.), *a slip*
con-sign', *to entrust*
pre-lu'-sive, *introductory*
um-bra'-geous, *shady*
as-suage', *to soften, to ease*
mit'-i-gate, *to lessen, to make more easy*
di-ur'-nal, *daily*

re-dund'-ant, *more than necessary*
de'-vi-ous, *going astray, or out of the usual path*
per-en'-ni-al, *lasting, continuing through years*
or'-i-ent (n.), *the east*
em-pyr'-e-al, *refined, beyond aerial matter*
in'-fin-ite, *boundless, endless*

THE north-east spends his rage; he now, shut up
Within his iron cave, the effusive south
Warms the wide air, and o'er the void of heaven
Breathes the big clouds with vernal showers distent.
At first, a dusky wreath they seem to rise,
Scarce staining either, but by swift degrees,
In heaps on heaps the doubled vapour sails
Along the loaded sky, and mingling deep,
Sits on the horizon round, a settled gloom;
Not such as wintry storms on mortals shed,
Oppressing life; but lovely, gentle, kind,
And full of every hope, of every joy,
The wish of nature. Gradual sinks the breeze
Into a perfect calm, that not a breath
Is heard to quiver through the closing woods,
Or rustling turn the many-twinkling leaves
Of aspen tall. The uncurling floods, diffused
In glossy breadth, seem, through delusive lapse,
Forgetful of their course. 'Tis silence all,
And pleasing expectation. Herds and flocks
Drop the dry sprig, and, mute-imploring, eye
The falling verdure. Hushed in short suspense,
The plumed people streak their wings with oil,
To throw the lucid moisture trickling off,
And wait the approaching sign, to strike at once
Into the general choir. Even mountains, vales,
And forest, seem impatient to demand
The promised sweetness. Man superior walks
Amid the glad creation, musing praise,
And looking lively gratitude. At last,

The clouds consign their treasures to the fields,
 And, softly shaking on the dimpled pool
 Prelusive drops, let all their moisture flow
 In large effusion o'er the freshened world.
 The stealing shower is scarce to patter heard,
 By such as wander through the forest-walks,
 Beneath the umbrageous multitude of leaves.

The Seasons.

HASSAN, OR THE CAMEL DRIVER.

(*William Collins.*)

[Born, 1720 : died, 1756. Works : 'Oriental Eclogues' and 'Odes.'

Scene—The Desert. Time—Midday.

IN silent horror, o'er the boundless waste,
 The driver Hassan with his camels past ;
 One cruse of water on his back he bore,
 And his light scrip contained a scanty store ;
 A fan of painted feathers in his hand,
 To guard his shaded face from scorching sand.
 The sultry sun had gained the middle sky,
 And not a tree and not an herb was nigh ;
 The beasts with pain their dusty way pursue,
 Shrill roared the winds, and dreary was the view !
 With desperate sorrow wild, the affrighted man
 Thus sighed, thrice struck his beast, and thus began :
 'Sad was the hour, and luckless was the day,
 When first from Schiraz' walls I bent my way.'
 Ah ! little thought I of the blasting wind,
 The thirst or pinching hunger that I find !
 Bethink thee, Hassan ! where shall thirst assuage,
 When fails this cruse, his unrelenting rage ?
 Soon shall this scrip its precious load resign,
 Then what but tears and hunger shall be thine ?
 Ye mute companions of my toils, that bear
 In all my griefs a more than equal share !
 Here, where no springs in murmurs break away,
 Or moss-crowned fountains mitigate the day,
 In vain ye hope the green delight to know,
 Which plains more blest, or verdant vales bestow ;
 Here rocks alone and tasteless sands are found,
 And faint and sickly winds for ever howl around.
 'Sad was the hour, and luckless was the day,
 When first from Schiraz' walls I bent my way'

Curs'd be the gold and silver which persuade
Weak men to follow far fatiguing trade!
The lily peace outshines the silver store,
And life is dearer than the golden ore;
Yet money tempts us o'er the desert brown,
To every distant mart and wealthy town.
Full oft we tempt the land, and oft the sea;
And are we only yet repaid by thee!
Ah! why was ruin so attractive made,
Or why fond man so easily betrayed?
Why heed we not, while mad we haste along,
The gentle voice of peace, or pleasure's song?
Or wherefore think the flowery mountain's side,
The fountain's murmurs, and the valley's pride;
Why think we these less pleasing to behold
Than dreary deserts, if they lead to gold?
'Sad was the hour, and luckless was the day,
When first from Shiraz' walls I bent my way!'
Oh cease my fears! All frantic as I go,
When thought creates unnumbered scenes of woe,
What if the lion in his rage I meet!
Oft in the dust I view his printed feet;
And fearful oft, when Day's declining light
Yields her pale empire to the mourner Night;
By hunger roused he scours the groaning plain,
Gaunt wolves and sullen tigers in his train;
Before them Death, with shrieks directs their way,
Fills the wild yell and leads them to their prey.
'Sad was the hour, and luckless was the day,
When first from Schiraz' walls I bent my way!'
At that dead hour the silent asp shall creep,
If aught of rest I find, upon my sleep;
Or some swoln serpent twist his scales around
And wake to anguish with a burning wound.
Thrice happy they, the wise contented poor,
From lust of wealth and dread of death secure!
They tempt no deserts, and no griefs they find;
Peace rules the day where reason rules the mind.
'Sad was the hour, and luckless was the day,
When first from Schiraz' walls I bent my way!'
O hapless youth! for she thy love hath won,
The tender Zara! will be most undone.
Big swelled my heart, and owned the powerful maid,
When fast she dropped her tears, as thus she said:
"Farewell the youth whom sighs could not detain,
Whom Zara's breaking heart implored in vain!
Yet as thou go'st, may every blast arise

Weak and unfelt as those rejected sighs;
 Safe o'er the wild no perils may'st thou see,
 No griefs endure, nor weep, false youth! like me."
 'O! let me safely to the fair return,
 Say, with a kiss, she must not, shall not mourn;
 O! let me teach my heart to lose its fears,
 Recalled by Wisdom's voice, and Zara's tears.'
 He said, and called on Heaven to bless the day
 When back to Schiras' walls he bent his way.

Eclogue II. ('Oriental Eclogues.')

ASPIRATIONS AFTER THE INFINITE.

(Mark Akenside.)

[Born, 1721; died, 1770. Chief poem: 'The Pleasures of the Imagination.']

SAY, why was man so eminently raised
 Amid the vast creation; why ordained
 Through life and death to dart his piercing eye,
 With thoughts beyond the limits of his frame;
 But that the Omnipotent might send him forth
 In sight of mortal and immortal powers,
 As on a boundless theatre, to run
 The great career of justice; to exalt
 His generous aim to all diviner deeds;
 To chase each partial purpose from his breast;
 And through the mist of passion and of sense,
 And through the tossing tide of chance and pain,
 To hold his course unfaltering, while the voice
 Of Truth and Virtue, up the steep ascent
 Of Nature, calls him to his high reward,
 The applauding smile of Heaven? Else wherefore burns
 In mortal bosoms this unquenched hope,
 That breathes from day to day sublimer things,
 And mocks possession? wherefore darts the mind
 With such resistless ardour to embrace
 Majestic forms; impatient to be free,
 Spurning the gross control of wilful might;
 Proud of the strong contention of her toils;
 Proud to be daring? who but rather turns
 To Heaven's broad fire his unconstrained view,
 Than to the glimmering of a waxen flame?
 Who that, from Alpine heights, his labouring eye

Shoots round the wide horizon, to survey
Nilus or Ganges rolling his bright wave
Through mountains, plains, through empires black with shade,
And continents of sand, will turn his gaze
To mark the windings of a scanty rill
That murmurs at his feet? The high-born soul
Disdains to rest her heaven-aspiring wing
Beneath its native quarry. Tired of earth
And this diurnal scene, she springs aloft
Through fields of air, pursues the flying storm,
Rides on the vollied lightning through the heavens;
Or, yoked with whirlwinds, and the northern blast,
Sweeps the long tract of day. Then high she soars
The blue profound, and hovering round the sun,
Beholds him pouring the redundant stream
Of light; beholds his unrelenting sway,
Bend the reluctant planets to absolve
The fated rounds of Time. Thence far effused,
She darts her swiftness up the long career
Of devious comets; through its burning signe
Exulting measures the perennial wheel
Of Nature, and looks back on all the stars,
Whose blended light, as with a milky zone,
Invest the orient. Now, amazed she views
The empyreal waste, where happy spirits hold,
Beyond this concave heaven, their calm abode;
And fields of radiance, whose unfading light
Has travelled the profound six thousand years,
Nor yet arrives in sight of mortal things.
Even on the barriers of the world, untired,
She meditates the eternal depth below;
Till half recoiling, down the headlong steep
She plunges; soon o'erwhelmed and swallowed up
In that immense of being. There her hopes
Rest at the fated goal. For from the birth
Of mortal man, the Sovereign Maker said,
That not in humble nor in brief delight,
Not in the fading echoes of Renown,
Power's purple robes, nor Pleasure's flowery lap,
The soul should find enjoyment; but from these
Turning disdainful from an equal good,
Through all the ascent of things enlarge her view,
Till every bound at length should disappear,
And infinite perfection close the scene.

The Pleasures of the Imagination.

COMPOUND INTEREST.

- (1) What will be the compound interest on £1,000 for 4 years at 5 per cent. per annum?
- (2) What will £175 amount to in 3 years at 6 per cent. per annum, compound interest?
- (3) What will be the compound interest on 1,000 guineas for 5 years at $4\frac{1}{2}$ per cent. per annum?
- (4) What sum must I invest to produce £964 10s. $7\frac{1}{4}d.$ in 4 years at 6 per cent., compound interest?
- (5) What must be paid for a debt of £128 0s. $11\frac{1}{2}d.$, due 7 years hence, compound interest at the rate of 5 per cent. being calculated?

THE LLANOS.

(From the 'Tropical World,' by Dr. Hartwig.)

col-*os'*-sal, huge, immense
 prim'-i-tive, as it existed at the beginning
 vert'-i-cal, overhead
 cal'-ci-ned, burnt to ashes
 mon-*ot'*-on-ous, wanting variety in sound
 in-term'-in-a-ble, without end
 vi-cis'-si-tudes, changes, misfortunes
 ne-pen'-thes, the pitcher-plant or monkey-
 cup
 glob'-u-lar, round
 stra'-ta (Lat), plural of stratum, a
 layer
 sem'-blance, appearance

den'-si-ty, thickness, closeness of the
 particles
 pul-sa'-tions, beatings caused by the flow
 of the blood to and from the heart
 stag-na'-tion, a standing still
 a'-rid, dry, parched
 mi'-gra-tor-y, wandering
 dev'-as-ta-ting, destroying
 zen'-ith, the point of the heavens imme-
 diately overhead
 sau'-ri-ans, reptiles; all animals of the
 lizard species

IN South America the features of Nature are traced on a gigantic scale. Mountains, forests, rivers, plains, there appear in far more colossal dimensions than in our part of the world. Many a branch of the Marañon surpasses the Danube in size. In the boundless primitive forests of Guiana more than one Great Britain could find room. The Alps would seem but of moderate elevation if placed aside of the towering Andes; and the plains of Northern Germany and Holland are utterly insignificant when compared with the Llanos of Venezuela and New Grenada, which, stretching from the coast-chain of Caraccas to the forests of Guiana, and from the snow-crowned mountains of Merida to the Delta of the Orinoco, cover a surface of more than 250,000 square miles. Nothing can be more remarkable than the contrast which these immeasurable plains present at various seasons of the year, now parched by a long-continued drought, and now covered with the most luxuriant vegetation. When, day after day, the sun, rising and setting in a cloudless

sky, pours his vertical rays upon the thirsty Llanos, the calcined grass-plains present the monotonous aspect of an interminable waste. Like the ocean, their limits melt in the hazy distance with those of the horizon; but here the resemblance ceases, for no refreshing breeze wafts coolness over the desert, and comforts the drooping spirits of the wanderer.

In the wintry solitudes of Siberia the skin of the reindeer affords protection to man against the extreme cold; but in these sultry plains there is no refuge from the burning sun above, and the heat reflected from the glowing soil, save where, at vast intervals, small clumps of the *Mauritia* palm afford a scanty shade. The waterpools which nourished this beneficent tree have long since disappeared; and the marks of the previous rainy season, still visible on the tall reeds that spring from the marshy ground, serve only to mock the thirst of the exhausted traveller. The long-legged jabiru and the scarlet ibis have forsaken the dried-up swamp, which no longer affords them any subsistence, and only here and there a solitary Caracara falcon lingers on the spot, as if meditating on the vicissitudes of the season. Yet even now the parched savannah has some refreshment to bestow, as Nature—which in the East Indian forests fills the pitchers of the nepenthes with a grateful liquid, and in the waterless Kalakari causes many juicy roots to thrive under the surface of the desert—here also displays her bounty; for the globular melon-cactus, which flourishes on the driest soil, and not seldom measures a foot in diameter, conceals a juicy pulp under its tough and prickly skin. Guided by an admirable instinct, the wary mule strikes off with his fore-feet the long, sharp thorns of this remarkable plant, the emblem of good nature under a rough exterior, and then cautiously approaches his lips to sip the refreshing juice. Yet, drinking from these living sources is not unattended with danger, and mules are often met with that have been lamed by the formidable prickles of the cactus. The wild horse and ox of the savannah, not gifted with the same sagacity, roam about a prey to hunger and burning thirst, the latter hoarsely bellowing, the former snuffing up the air with outstretched neck, to discover by its moisture the neighbourhood of some pool that may have resisted the general drought.

Besides their interminable extent, the Llanos have several other points of resemblance to the sea. As here the water-spout, raised by contending air-currents, rises to the clouds and sweeps over the floods, thus also the dust of the savannah, set in motion by conflicting winds, ascends in mighty columns and glides over the desert plain. The glowing sand, suspended in the air, increases the sultriness of the atmosphere, and may even become dangerous to the traveller who cannot escape by

a timely flight; for, seizing him with irresistible violence, it carries him along in its embrace, and then hurls him senseless to the ground.

As if 'on a painted ocean,' the becalmed ship lies motionless on the glassy sea. No breath of air ruffles the surface of the waters. The pennant hangs lazily from the mast; the water-cocks are empty; the torments of thirst, aggravated by the heat of a vertical sun, become intolerable. But, suddenly, as if by magic, a beautiful island rises from the floods; waving palm trees seem to welcome the mariner; he fancies he hears the purling of the brook and the splashing of the waterfall. Yet still the vessel remains immovable like a rock, and soon the fading phantom that mocked his misery leaves him the victim of increased despair.

Similar delusions of the mirage, produced by the refraction of the light as it passes through atmospherical strata of unequal warmth, and consequently of unequal density, likewise take place over the surface of the Llanos, which then assume the semblance of a large sea, heaving and rocking in wave-like motion. In the Lybian desert, in the dread solitudes of the polar ocean, in every zone, we meet with the same phenomenon, produced by the same cause.

As in the arctic regions the intense cold during winter retards pulsation, or even suspends the operations of life, so in the Llanos the long continuance of drought causes a similar stagnation in animated nature. The thinly-scattered trees and shrubs do not indeed cast their foliage, but the greyish yellow of their leaves announces that vegetation is suspended. Buried in the clay of the dried-up pools, the alligator and the water boa lie plunged in a deep summer sleep, like the bear of the north in his long winter slumber; and many animals which, at other times, are found roaming over the Llanos—such as the graceful agutè, the hoggish peccary, and the timid deer of the savannah—have left the parched plains and migrated to the forest or the river. The large maneless puma, and the spotted jaguar, following their prey to less arid regions, are now no longer seen in their former hunting-grounds, and the Indian has also disappeared with the stag he pursued with his poisoned arrows. In Siberia, the reindeer and the migratory birds are scared away by winter; here life is banished and suspended by an intolerable heat.

Sometimes the ravages of fire are added to complete the image of death on the parched savannah.

'We had not yet penetrated far into the plain,' says Schomburgk, 'when we saw to the south-east high columns of smoke ascending to the skies, the sure signs of a savannah fire, and at the same time the Indians anxiously pressed us to speed on, as

the burning torrent would most likely roll in our direction. Although at first we were inclined to consider their fears exaggerated, yet the next half-hour served to convince us of the extreme peril of our situation. In whatever direction we gazed, we nowhere saw a darker patch in the grass-plain announcing the refuge of a water-pool; we could already distinguish the flames of the advancing column, already hear the bursting and crackling of the reeds, when fortunately the sharp eye of the Indians discovered some small eminences before us, only sparingly covered with a low vegetation, and to these we now careered as if Death himself was behind us. Half a minute later, and I should never have lived to relate our adventures. With beating hearts we saw the sea of fire rolling its devouring billows towards us; the suffocating smoke, striking in our faces, forced us to turn our backs upon the advancing conflagration, and to await the dreadful decision with the resignation of helpless despair.

‘And now we were in the midst of the blaze. Two arms of fire encircled the base of the little hillock on which we stood, and united before us in a waving mass, which, rolling onwards, receded farther and farther from our gaze. The flames had devoured the short grass of the hillock, but had not found sufficient nourishment for our destruction. Whole swarms of voracious vultures followed in circling flight the fiery column, like so many hungry jackals, and pounced upon the snakes and lizards which the blaze had stifled and half-calined in its murderous embrace. When, with the rapidity of lightning, they darted upon their prey and disappeared in the clouds of smoke, it almost seemed as if they were voluntarily devoting themselves to a fiery death. Soon the deafening noise of the conflagration ceased, and the dense black clouds in the distance were the only signs that the fire was still proceeding on its devastating path over the wide wastes of the savannah.’

At length, after a long drought, when all Nature seems about to expire under the want of moisture, various signs announce the approach of the rainy season. The sky, instead of its brilliant blue, assumes a leaden tint, from the vapours which are beginning to condense. The black spot of the ‘Southern Cross,’ that most beautiful of constellations, in which, as the Indians poetically fancy, the Spirit of the savannah resides, becomes more indistinct as the transparency of the atmosphere diminishes. The fixed stars, which shine with a quiet planetary light, now twinkle even in the zenith. Like distant mountain-chains, banks of clouds begin to rise over the horizon, and forming in masses of increasing density, to ascend higher and higher, until at length the sudden lightnings flash from their dark bosom, and with the loud crash of thunder, the

first rains burst in torrents over the thirsty land. Scarcely have the showers had time to moisten the earth, when the dormant powers of vegetation begin to awaken with an almost miraculous rapidity. The dull, tawny surface of the parched savannah changes as if by magic into a carpet of the most lively green, enamelled with thousands of flowers of every colour. Stimulated by the light of early day, the mimosas expand their delicate foliage, and the fronds of the beautiful mauritias sprout forth with all the luxuriance of youthful energy.

And now, also, the animal life of the savannah awakens to the full enjoyment of existence. The horse and ox rejoice in the grasses, under whose covert the jaguar frequently lurks to pounce upon them with his fatal spring. On the border of the swamps, the moist clay, slowly heaving, bursts asunder, and from the tomb in which he lay embedded rises a gigantic water snake or huge crocodile. The new-formed pools and lakes swarm with life, and a host of water-fowl,—ibises, cranes, flamingoes, mycterias,—make their appearance to regale on the prodigal banquet. A new creation of insects and other unbidden guests now seek the wretched hovels of the Indians, which are sparingly scattered over the higher parts of the savannah. Countless multitudes of ants, sandflies, and mosquitoes; rattlesnakes, expelled by the cold and moisture from the lower grounds; repulsive gleks, which, with incredible rapidity, run along the overhanging rafters; nauseous toads, which, concealing themselves by day in the dark corners of the huts, crawl forth in the evening in quest of prey; lizards, scorpions, centipedes; in a word, worms and vermin of all names and forms,—emerge from the inundated plains, for the tropical rains have gradually converted the savannah, which erewhile exhibited a waste as dreary as that of the Sahara, into a boundless lake. The swollen rivers of the steppe—the Apure, the Arachuma, the Pajara, the Arauca,—pour in mighty streams over the plains, and boats are now able to sail for miles across the land, from one river bed into another.

On the same spot where, but a short time ago, the thirsty horse anxiously snuffed the air to discover by its moisture the presence of some pool, the animal is now obliged to lead an amphibious life. The mares retreat with their foals to the higher banks, which rise like islands above the waters, and as from day to day the land contracts within narrower limits, the want of forage obliges them to swim about in quest of the grasses that raise their heads above the fermenting waters. Many foals are drowned; many are surprised by the crocodiles, that strike them down with their jagged tails, and then crush them between their jaws. Horses and oxen are not seldom met

with, which, having fortunately escaped these huge saurians, bear on their limbs the marks of their sharp teeth.

BANKERS' DISCOUNT.

- (1) What is the discount on £100 due in 3 months at 8 per cent. per annum?
- (2) What is the present value of £230 10s. due 220 days hence at 4 per cent. per annum?
- (3) What is the discount on a bill of £800 due 61 days hence at 5 per cent. per annum?
- (4) If the present value of a bill for £300 due at 91 days be £296 5s. $2\frac{1}{4}d.$, what is the rate of discount?
- (5) If the bank rate of discount be $7\frac{1}{2}$ per cent., and I receive £493 15s. for a £500 bill, in what time would it have become due?

THE IMPEACHMENT OF AND ATTEMPT TO ARREST THE FIVE MEMBERS.

A.D. 1641-2.

(From the 'Comprehensive History of England,' by C. Macfarlane and Rev. T. Thomson.)

cri'-sis (Gr.) pl. cri'-ses, a turning point
for good or ill
pris'-tine, *first, original, ancient*
vague, wandering, not precise
com-bus'-tion, tumult, confusion, burn-
ing

al-le'-gi-ance, the duty of a subject to the
government
am'-nes'-ty, an act of general pardon
con-cil'-i-a-tor-y, tending to conciliate or
reconcile

[This event is remarkable as being the crisis of the quarrel between Charles I. and the Parliament, and the immediate cause of both sides preparing for hostilities. The excitement and fear produced by this act led the king to quit London, 'never to return till the day of a terrible and memorable reckoning had arrived.' After several months of fruitless negotiation, the Civil War began, August 1642.]

On the last day of this eventful year the commons sent Mr. Denzil Hollis to the king, with what they called an address to his majesty, praying for a guard, and an answer without delay. Hollis told the king, by word of mouth, that the House of Commons were ready to spend the last drop of their blood for his majesty, but that they had great apprehensions and just fears of mischievous designs to ruin and destroy them; that there had been several attempts made heretofore to bring destruction upon their whole body at once, and threats and menaces used against particular persons; that there was a malignant party daily gathering strength and confidence, and now come to such a height as to imbrue their hands in blood in the face and at the very doors of the parliament; and that the same party, at his majesty's own gates, had given out

insolent and menacing speeches against the parliament itself. And in the end Hollis informed him that it was the humble desire of the commons to have a guard to protect them out of the city, and commanded by the Earl of Essex, chamberlain of his majesty's household, and equally faithful to his majesty and the commonwealth. Charles desired to have this message in writing; the paper was sent to him accordingly, and he replied to it, not without delay, as the commons had requested or enjoined, but three days after. In the interval the commons had ordered that halberts should be provided and brought into the house for their own better security. The halberts were brought in accordingly, and Rushworth informs us that they stood in the house for a considerable time afterwards. Then, understanding that the lords would not sit on the morrow, which was New Year's Day, they adjourned till Monday, the 3rd of January, resolving, however, that they should meet on the morrow, in a grand committee at Guildhall, leaving another committee at Westminster to receive his majesty's answer to their petition, if it should come in the meantime.

On January 3rd, the commons, meeting in their usual place, received the king's tardy and unsatisfactory answer to their petition for a guard. Charles expressed his great grief of heart at finding, after a whole year's sitting of this parliament, that there should be such jealousies, distrusts, and fears; he protested his ignorance of the grounds of their apprehension, and he offered to appoint them a guard if they should continue to think one necessary. A guard of the king's appointing was precisely the thing that the commons did not want. While they were debating upon the message, they received a communication from the lords, the effect of which was galvanic. That morning Herbert, the king's attorney, was admitted into the House of Lords, at the request of the lord-keeper, and approaching the clerk's table (not the bar), Herbert said that the king had commanded him to tell their lordships that divers great and treasonable designs and practices against him and the state had come to his majesty's knowledge. For which, continued Herbert, 'his majesty hath given me command, in his name, to accuse, and I do accuse, by delivering unto your lordships these articles in writing, which I received of his majesty, the six persons therein named of high treason, the heads of which treason are contained in the said articles, which I desire may be read. The lords took the articles, and commanded the reading of them. They were entitled 'Articles of high treason, and other high misdemeanours, against the Lord Kimbolton, Mr. Denzil Hollis, Sir Arthur Hazlerig, Mr. John Pym, Mr. John Hampden, and Mr. William Strode. The seventh and

the last, and most significant article, affirmed 'that they have traitorously conspired to levy, and actually have levied, war against the king.' Lord Kimbolton, who was in his seat, stood up, and expressed his readiness to meet the charge, offering to obey whatever the house should order. None of the courtiers had courage to move his arrest as a traitor. The lords wavered, stood still, and then appointed a committee, consisting of the lord steward, and the Earls of Essex, Bath, Southampton, Warwick, Bristol, and Holland, to consider precedents and records touching the regularity of this accusation, and to discover whether such an accusation might be brought by the king's attorney into their house against a peer, &c. Thus they avoided committing themselves, gained time, and no doubt made sure that the commons, whom they warned by message, would take the affair upon themselves. And nearly at the same moment that their message was delivered in the lower house, information was also carried thither that several officers were sealing up the doors, trunks, and papers of Hampden, Pym, and the other accused members. Upon which the commons instantly voted, 'That if any person whatsoever shall come to the lodgings of any member of this house, and offer to seal the trunks, doors, or papers of any of them, or seize upon their persons, such member shall require the aid of the constable to keep such persons in safe custody till this house do give further order; and that if any person whatsoever shall offer to arrest or detain the person of any member without first acquainting this house, it is lawful for such member, or any person, to assist him, and to stand upon his or their guard of defence, and to make a resistance, according to the protestation taken to defend the privileges of parliament.' They also ordered that the serjeant-at-arms attending their house should proceed and break open the seals set upon the doors, papers, &c., of Mr. Hampden and the rest; and that the speaker should sign a warrant for the apprehension of those who had done the deed. The house then desired an immediate conference with the lords; but before they could receive an answer, they were told that a serjeant-at-arms was at their door with a message to deliver from his majesty to their speaker. Forthwith they called in the said serjeant to the bar, making him, however, leave his mace behind him. 'I am commanded by the king's majesty, my master,' said the serjeant, 'upon my allegiance, to require of Mr. Speaker five gentlemen, members of the House of Commons; and those gentlemen being delivered, I am commanded to arrest them, in his majesty's name, of high treason; their names are Denzil Hollis, Arthur Hazlerig, John Pym, John Hampden, and William Strode.' When he had delivered *this message*, the house commanded him to withdraw, and sent

Lord Falkland and three other members to acquaint his majesty that the matter was of great consequence, and that the House of Commons would take it into their serious consideration, holding the members ready to answer any legal charge made against them.

All this was on January 3rd. 'The next day after that the king had answered the petition of the house (about the guard), being January 4th, 1642,' says May, 'he gave, unhappily, a just occasion for all men to think that their fears and jealousies were not causeless. He spent the preceding evening in making preparations. Arms were removed from the Tower to Whitehall, where a table was spread in the palace for a band of rash young men, who were ready to proceed to extremities for the reestablishment of royalty in its pristine state. Charles had determined to charge the five members with private meetings and treasonable correspondence with the Scots (a case met and provided for by the amnesty which had been procured both in Scotland and England), and with countenancing the late tumults from the city of London, and he now resolved to go in person to seize the five members of the House of Commons. On the morning of the 4th, the five accused members attended in their places, as they had been ordered. Lord Falkland stated that he was desired to inform the house that the serjeant-at-arms had done nothing the preceding day but what he had it in command to do. Then Hampden rose, and powerfully repelled the vague accusations which had been brought against him by the king. If to be resolute in the defence of parliament, the liberties of the subject, the reformed religion, was to be a traitor, then he acknowledged he might be guilty of treason, but not otherwise. Hazlerig followed Hampden. The house being informed that it was Sir William Fleming and Sir William Killigrew, with others, who had sealed up the studies and papers of the five members, ordered that they should be forthwith apprehended, and kept in the custody of the serjeant-at-arms till further notice. They also voted that a conference should be desired with the lords, to acquaint them of a scandalous paper, published with articles of high treason, against their five members and the Lord Kimbolton, a peer. The house rose at the usual dinner-hour, but met again immediately after. They had scarcely taken their seats when intelligence was brought by Captain Langrish, who had passed the party in the streets, that the king was advancing towards Westminster Hall, guarded by his gentleman pensioners, and followed by some hundreds of courtiers, officers, and soldiers of fortune, most of them armed with swords and pistols. The house was bound by its recent and solemn protestations to protect its privileges and the persons of its members; there were halberts

and probably other arms at hand, but could they defend their members against this array, led on by the king in person? Would it be wise, on any grounds, to make the sacred inclosures of parliament a scene of war and bloodshed? They ordered the five members to withdraw 'to the end,' says Rushworth, 'to avoid combustion in the house, if the said soldiers should use violence to pull any of them out.' Four of the members yielded ready obedience to this prudent order, but Mr. Strode insisted upon staying and facing the king, and was obstinate till his old friend Sir Walter Earle pulled him out by force, the king being at that time entering into New Palace Yard, and almost at the door of the house. As Charles passed through Westminster Hall to the entrance of the House of Commons, the officers, reformados, &c., that attended him made a lane on both sides the hall, reaching to the door of the commons. He knocked hastily, and the door was opened to him. Leaving his armed band at the door and in the hall, he entered the house with his nephew Charles, the Prince-palatine of the Rhine, at his side. He glanced his eyes towards the place where Pym usually sat, and then walked directly to the chair, saying, 'By your leave, Mr. Speaker, I must borrow your chair a little.' Lenthall, the speaker, dropped upon his knee, and Charles took his seat; the mace was removed, the whole house stood up uncovered. Charles cast searching glances among them, but he could nowhere see any of the five members. He then sat down, and addressed them, with much agitation:—'Gentlemen,' said he, 'I am sorry for this occasion of coming unto you; yesterday I sent a serjeant-at-arms, upon a very important occasion, to apprehend some that upon my commandment were accused of high treason, whereunto I did expect obedience, and not a message; and I must declare unto you here, that albeit no king that ever was in England shall be more careful of your privileges, to maintain them to the utmost of his power, than I shall be, yet you must know that in cases of treason no person hath a privilege, and therefore I am come to know if any of these persons that I have accused, for no slight crime, but for treason, are here. I cannot expect that this house can be in the right way that I do heartily wish it; therefore I am come to tell you that I must have them wheresoever I find them.' Then he again looked round the house, and said to the speaker, now standing below the chair, 'Are any of those persons in the house? do you see any of them? where are they?' Lenthall fell on his knees, and told his majesty that he had neither eyes to see, nor tongue to speak, in that place, but as the house was pleased to direct him. Then again casting his eyes round about the house, Charles said, 'Well, since I see all the birds are flown, I do expect from you that you do send them to me as

soon as they return hither. But I assure you, on the word of a king, I never did intend any force, but shall proceed against them in a legal and fair way, for I never meant any other. And now, since I see I cannot do what I came for, I think this no unfit occasion to repeat what I have said formerly, that whatsoever I have done in favour, and to the good of my subjects, I do mean to maintain it. I will trouble you no more, but tell you I do expect, as soon as they come to the house, you will send them to me; otherwise I must take my own course to find them.' With these words the disappointed king rose and retired, amidst loud cries of 'Privilege! privilege!' and the house instantly adjourned. That night the city was a gayer place than the court. Early on the following morning the commons, safe in 'that mighty heart,' sent Mr. Fiennes with a message to the lords, to give them notice of 'the king's coming yesterday,' and to repeat their desires that their lordships would join with them in a petition for a guard to secure them, and also to let them know that they were sitting at Guildhall, and had appointed the committee for the pressing Irish affairs to meet there. The commons then appointed that a permanent committee should sit at Guildhall, in the city of London, with power to consider and resolve of all things that might concern the good and safety of the city; and thereupon adjourned till Tuesday, January 11th, at one in the afternoon. In the meantime, Charles had sent orders to stop the seaports, as if the five members could be scared into a flight. On the morning, after a night of painful doubt and debate, Charles set off to the city in person, with his usual attendants, but without any reformados or bravos. On his way he was saluted with cries of 'Privileges of parliament!' 'Privileges of parliament!' and one Henry Walker, an ironmonger and pamphlet writer, threw into his majesty's coach a paper whereon was written, 'To your tents, O Israel.' The common council had assembled at Guildhall, and they met the king as he went up to that building almost alone. Concealing his ill-humour, and his irritation against the citizens, he thus addressed them:— 'Gentlemen, I am come to demand such persons as I have already accused of high treason, and do believe are shrouded in the city. I hope no good man will keep them from me; their offences are treasons and misdemeanours of a high nature. I desire your loving assistance herein, that they may be brought to a legal trial. And whereas there are divers suspicions raised that I am a favourer of the Popish religion, I do profess in the name of a king, that I did, and ever will, and that to the utmost of my power, be a prosecutor of all such as shall any ways oppose the laws and statutes of this kingdom, either Papists or Separatists, and not only so, but I will maintain and defend that true Protestant religion which

my father did profess, and I will continue it during my life.' This conciliatory speech produced little or no effect; Charles did not get the five members, but he got a very good dinner at the house of one of the sheriffs, and after dinner returned to Whitehall without interruption or tumult.

TRUE DISCOUNT.

- (1) What is the true discount on £320 due in 4 months at 6 per cent. per annum?
- (2) What is the present value of £370 due 100 days hence at $4\frac{1}{2}$ per cent. true discount?
- (3) What is the true discount on £627 due in 120 days at 10 per cent. per annum?
- (4) A bill of £78 10s. will become due on the 1st of September; what ready money will pay it on the preceding 3rd of July, allowing 6 per cent. per annum true discount?
- (5) What is the present value of a £762 bill payable on October 13th, if I discount it on August 1st at 8 per cent.?
- (6) Should I gain or lose by using true instead of ordinary discount in the above case, and how much?

SCIENCE AND POETRY.

(From the 'Museum of Science and Art,' by Dr. Lardner.)

noc-tur'-nal, *nightly*
 cli-mat-o-lo'-gi-cal, *relating to the laws*
 of climate
 ul'-tra trop'-i-cal, *beyond the tropics*
 in-com-pat-i-bil'-i-ty, *inconsistency*
 vis'-u-al, *relating to the sight*
 hy-per-crit'-i-cal, *critical beyond reason*

as-tro-nom'-i-cal, *relating to the science*
 of astronomy
 lo'-cus stan-di (Lat.), *a standing place*
 or'-i-fice, *an opening*
 pos-te'-ri-or, *later, back*
 pho-to-met'-ric, *relating to the measure-*
 ment of light

IN one of his Irish melodies, so familiar to all lovers of poetry and music, Moore has the following lines:—

Oh! had we some bright little isle of our own,
 In a blue summer ocean far off and alone,
 Where a leaf never dies in the still blooming bowers,
 And the bee banquets on through a whole year of flowers;
 Where the sun loves to pause
 With so fond a delay,
 That the night only draws
 A thin veil o'er the day;
 Where simply to feel that we breathe, that we live,
 Is worth the best joys that life elsewhere can give.

Now this is good poetry, but bad science. An 'isle' in which 'a leaf never dies,' and in which the flowers bloom through the year, must necessarily be within the tropics, a latitude to which the succeeding lines about the 'fond delay' of the sun and the night, which only 'draws a thin veil o'er the day,' which pro-

duces, in other words, only a few hours of twilight, are utterly inapplicable.

In tropical latitudes the variation of the length of the day is very inconsiderable. It is a little more or less than twelve hours, and that is all. The night is, consequently, subject to a variation similarly limited. Instead, therefore, of the very long day and the very short nights which the poet ascribes to his 'isle' in the blue summer ocean, there would necessarily be nights, the duration of which could never be much less than twelve hours in any part of the year.

But this is not all. Instead of enjoying a constant nocturnal twilight, so beautifully described by the poet as a veil drawn over the day, the inhabitants of the tropics enjoy scarcely any twilight at all, being plunged in nocturnal darkness almost immediately after sunset. This arises from astronomical causes, which will be very easily understood.

Twilight is produced by the reflection of the sun's light from that part of the visible atmosphere upon which the sun continues to shine after sunset until its depression below the horizon amounts to about 18° . Now it is apparent, that the more nearly perpendicular to the horizon the diurnal motion of the sun is, the sooner will its orb attain this depression of 18° . In the higher latitudes, where the celestial pole is not very far removed from the zenith, the sun is carried round in a diurnal circle, making a very oblique angle with the horizon; consequently, after it sets, its depression below the horizon increases very slowly, and a long interval elapses before the depression amounts to 18° . In some latitudes, at the season of Midsummer, it is not so much as 18° even at midnight; and in such places the poet might very truly say,—

The night only draws
A thin veil o'er the day.

But the latitudes in which this can take place are very different indeed from those in which

A leaf never dies in the still blooming bowers,
And the bee banquets on through a whole year of flowers.

The distance of the celestial pole from the northern point of the horizon being always equal to the latitude of the place, the depression of the sun below the horizon at midnight will be found by subtracting the latitude of the place from the sun's polar distance. Now, the sun's polar distance at Midsummer is $66\frac{1}{2}^\circ$, and in order that its depression at midnight should not exceed 18° , the latitude of the place must at least be equal to $66\frac{1}{2}^\circ$, diminished by 18° , that is $48\frac{1}{2}^\circ$.

It follows, therefore, that an entire night of twilight can only take place at latitudes higher than $48\frac{1}{2}^\circ$. But to produce the

effect expressed by the poet, a twilight should be maintained much stronger than that characterised by the scientific sense of the term. A twilight which would be only a 'thin veil drawn over the day,' would be such as can be only witnessed in latitudes like those of Norway and Sweden, the northern parts of Scotland, the Orkneys, &c.

In tropical latitudes, on the contrary, the celestial pole has an altitude less than $23\frac{1}{2}^{\circ}$, and the diurnal path of the sun makes with the plane of the horizon an angle greater than $66\frac{1}{2}^{\circ}$. After sunset, the sun therefore descends very rapidly, and the more rapidly the nearer the place is to the line. At the line itself the sun attains the depression of 18° in about seventy-two minutes after sunset; and although the twilight in the scientific sense of the term would not terminate till then, it comes to a close much sooner in the poetic sense of the 'veil drawn o'er the day.' In short, an almost sudden darkness succeeds sunset, and, in like manner, sunrise succeeds as suddenly to the darkness of night.

In a word, the poet, in the beautiful lines cited above, has combined incompatible astronomical and climatological conditions. The perpetual summer necessarily infers tropical latitude, while the short twilighted night infers a high, not to say a polar latitude.

It would, perhaps, be deemed hypercritical to examine how far the naturalist would justify the poet in his allusion to the industry of the bee in a tropical climate. The honey-bee, which no doubt was the insect alluded to by the poet, is, for the most part, confined to ultra tropical latitudes. Since, however, there are certain species of this insect found in the lower latitudes, it may be admitted that the poet has, at least in this point, a *locus standi*.

Having had the pleasure of the personal acquaintance of the author of the *Melodies*, I once pointed out to him these scientific incompatibilities in his lines. He replied good-humouredly, that it was lucky when he wrote the song that such inconsistencies did not occur to him; for, if they had, some pretty thoughts would inevitably have been spoiled, since he could not have been brought knowingly to take such liberties with the divinities of astronomy and geography.

The allusion and imagery which Moore loved to seek in certain parts of physical science were generally much more consistent with physical truth, without being less beautiful, than that which we quoted above.

How happily, for example, did he avail himself of that beautiful property of the iris by which it accommodates the eye to greater and less degrees of light, enlarging the pupil when the light is faint, and contracting it when it is intense.

The iris, as is well known, is the coloured ring which surrounds the dark spot in the middle of the eye; this dark spot being not a black substance, but a circular orifice through which the light is admitted to the membrane lining the posterior part of the internal chamber of the eye. This circular orifice is called the pupil, the retina being the nervous membrane which produces the visual perceptions.

The iris which surrounds the pupil has a certain power of contraction and expansion, which is produced by the action upon it of proper muscles provided for that purpose.

The quantity of light admitted through the pupil to the retina is increased or diminished in the proportion of the area of the pupil, which increases and diminishes in proportion to the square of its diameter; a very small variation of which therefore produces a very considerable proportionate variation of the quantity of light admitted.

If a person, after remaining for some time in a room dimly lighted, pass suddenly into one which is strongly illuminated, he will become instantly sensible of pain in the retina, and will involuntarily close his eyes. After a short time, however, he will be enabled to open them and look around with impunity.

The cause of this is easily explained. In the dimly lighted room the pupil was widely expanded, to collect the largest quantity possible of the faint light, so that a sufficient quantity might be received by the retina to produce a sensible perception of the surrounding objects. On passing into the strongly illuminated room the expanded pupil admits so much of the intense light as to act painfully on the retina before there is time for the iris to adjust itself so as to contract the aperture of the pupil. After a short interval, however, this adjustment is made, and the area of the pupil being diminished in the same proportion as the intensity of the light to which it is exposed has been augmented in passing from one room to the other, the action upon the retina is proportionally mitigated, so that the eye can regard without pain the surrounding objects.

The reverse of all this takes place when the eye suddenly passes from strong to feeble illumination. The pupil contracted when exposed to the strong light is not sufficiently open to admit the rays of feeble light necessary to produce visual perception, and for some time the surrounding objects are invisible. When, however, the proper muscular apparatus has had time to act upon the air so as to enlarge the pupil, the rays are admitted in greater quantity, and the surrounding objects begin to be perceived. These phenomena are beautifully expressed by the lines of Moore:—

Thus when the lamp that lighted
The traveller, at first goes out,

He feels awhile benighted,
And lingers on in fear and doubt.
But soon the prospect clearing,
In cloudless starlight on he treads,
And finds no lamp so cheering
As that light which heaven sheds.

Nevertheless, there is a point in this which demands some explanation. It is implied in these lines that the source of nocturnal illumination is chiefly, if not exclusively, *starlight*. This has been in a great measure disproved in some memoirs published by Arago in the 'Annuaire du Bureau des Longitudes,' in which he shows that there must be some other source of nocturnal illumination than that of the stars. On nights, for example, which are thickly clouded there is sometimes a stronger light than on those in which the firmament is clear and serene. From this and other circumstances Arago argues that there must be some power of illumination in the clouds or in the atmosphere independently of the light which proceeds from the stars. This is a point, however, the full development of which would require more space and time than we can spare for it on the present occasion.

In another of Moore's poems we find the following beautiful lines:—

While gazing on the moon's light,
A moment from her smile I turn'd,
To look at orbs that, more bright,
In lone and distant glory burn'd,
But too far
Each proud star,
For me to feel its warning flame,
Much more dear,
That mild sphere,
Which near our planet smiling came.

Thus, Mary, be but thou my own;
While brighter eyes unheeded play,
I'll love those moonlight looks alone,
That bless my home and guide my way.

This is not only beautiful poetry, but sound astronomy. The distances of the stars are many hundreds of millions of times greater than that of the moon, but their actual splendour is in many cases greater than that of the sun. Thus it has been shown by calculations made upon observations which appear to admit of no doubt, that the star Sirius, commonly called the Dog Star, is a sun $146\frac{1}{2}$ times more splendid than that which illuminates our system. Its distance, however, is so enormous that the actual light which it sheds upon our firmament is less than the five thousand millionth part of the sun's light.

Another star, which is the principal one in the constellation of the Centaur, has been ascertained to be a sun whose splendour

is $2\frac{1}{2}$ times greater than that of ours, but, owing to its enormous distance, the light which it sheds in our firmament is twenty-two thousand million times less than that of the sun.

Sir John Herschel compared the light shed by this star from our firmament, and found by exact photometric measurement that it was 27,408 times less than the light of the full moon.

Shakspeare imputes to the cricket the sense of hearing—

I will tell it softly ; young crickets shall not hear me.

This was long considered as a scientific blunder on the part of the poet, the most eminent naturalists having maintained that insects in general have no sense of hearing. Brunelli, an Italian naturalist, however, has demonstrated that the cricket at least has that sense. Several of these insects, which he shut up in a chamber, continued their usual crinkling or chirping the whole day, except at moments when he alarmed them by suddenly knocking at the door. The noise always produced a temporary silence on their part. He contrived to imitate their sounds so well that the whole party responded in a chorus, but were instantly silenced on his knocking at the door.

He also made the following experiment:—He confined a male cricket on one side of his garden, while he put a female on the other side at liberty. The moment the belle heard the crink of her beau, she showed no coyness, but immediately made her way to him.

The female glowworm, which emits the phosphorescent light familiar to all who have dwelt in warm climates, remains comparatively stationary to await the approach of her mate, attracted to her by the light which she holds out to him—a circumstance of which Moore has availed himself with his usual felicity:—

Beautiful as is the light
The glowworm hangs out to allure
Her mate to her green bower at night.

The well-known economy of the bee was never more beautifully described than by Shakspeare, who puts the following comparison into the mouth of the Archbishop of Canterbury:—

True ! Therefore doth Heaven divide
The state of man in divers functions,
Setting endeavour in continual motion ;
To which is fixed, as an aim or butt,
Obedience : for so work the honey-bees ;
Creatures that, by a rule in nature, teach
The act of order to a peopled kingdom.
They have a king, and officers of sorts ;
Where some, like magistrates, correct at home ;
Others, like merchants, venture trade abroad ;
Others, like soldiers armed in their stings,
Make boot upon the summer's velvet buds ;
Which pillage they with merry march bring home

approaching doom, basked in the fresh morning air, with lively and blithesome feelings, and a few hours afterwards were laid low upon the earth. But we grow affecting: let us proceed. In plain common-place matter-of-fact, then, it was a fine morning—so fine that you would scarcely have believed that the few months of an English summer had yet flown by. Hedges, fields, and trees, hill and moorland, presented to the eye their ever-varying shades of deep rich green; scarce a leaf had fallen, scarce a sprinkle of yellow mingled with the hues of summer, warned you that autumn had begun. The sky was cloudless; the sun shone out bright and warm; the songs of birds, and hums of myriads of summer insects, filled the air; and the cottage gardens, crowded with flowers of every rich and beautiful tint, sparkled, in the heavy dew, like beds of glittering jewels. Everything bore the stamp of summer, and none of its beautiful colours had yet faded from the die. Such was the morning, when an open carriage in which were three Pickwickians (Mr. Snodgrass having preferred to remain at home), Mr. Wardle, and Mr. Trundle, with Sam Weller on the box beside the driver, pulled up by a gate at the roadside, before which stood a tall, raw-boned gamekeeper, and a half-booted, leather-leggined boy; each bearing a bag of capacious dimensions, and accompanied by a brace of pointers.

‘I say,’ whispered Mr. Winkle to Wardle, as the man let down the steps, ‘they don’t suppose we’re going to kill game enough to fill those bags, do they?’

‘Fill them!’ exclaimed old Wardle. ‘Bless you, yes; you shall fill one, and I the other; and when we’ve done with them, the pockets of our shooting-jackets will hold as much more.’

Mr. Winkle dismounted without saying anything in reply to this observation; but he thought within himself, that if the party remained in the open air until he had filled one of the bags, they stood a considerable chance of catching colds in their heads.

‘Hi, Juno, lass—hi, old girl; down, Dapp, down,’ said Wardle, caressing the dogs. ‘Sir Geoffrey still in Scotland, of course, Martin?’ The tall gamekeeper replied in the affirmative, and looked with some surprise from Mr. Winkle, who was holding his gun as if he wished his coat-pocket to save him the trouble of pulling the trigger, to Mr. Tupman, who was holding his as if he were afraid of it—as there is no earthly reason to doubt he really was.

‘My friends are not much in the way of this sort of thing yet, Martin,’ said Wardle, noticing the look. ‘Live and learn, you know. They’ll be good shots one of these days. I beg my friend Winkle’s pardon, though; he has had some practice.’

Mr. Winkle smiled feebly over his blue neckerchief, in ac-

knowledge of the compliment, and got himself so mysteriously entangled with his gun, in his modest confusion, that if the piece had been loaded, he must inevitably have shot himself dead upon the spot.

'You mustn't handle your piece in that ere way, when you come to have the charge in it, sir,' said the tall gamekeeper gruffly, 'or you will make cold meat of some on us.'

Mr. Winkle, thus admonished, abruptly altered its position, and in so doing contrived to bring the barrel into pretty smart contact with Mr. Weller's head.

'Hallo!' said Sam, picking up his hat, which had been knocked off, and rubbing his temple. 'Hallo, sir! if you comes it this vay, you'll fill one o' them bags, and something to spare, at one fire.'

Here the leather-leggined boy laughed very heartily, and then tried to look as if it was somebody else, whereat Mr. Winkle frowned majestically.

'Where did you tell the boy to meet us with the snack, Martin?' inquired Wardle.

'Side of One Tree Hill, at twelve o'clock, sir.'

'That's not Sir Geoffrey's land, is it?'

'No, sir; but it's close by it. It's Captain Boldwig's land; but there'll be nobody to interrupt us, and there's a fine bit of turf there.'

'Very well,' said old Wardle. 'Now the sooner we're off the better. Will you join us at twelve, then, Pickwick?'

Mr. Pickwick was particularly desirous to view the sport, the more especially as he was rather anxious in respect of Mr. Winkle's life and limbs. On so inviting a morning, too, it was very tantalising to turn back, and leave his friends to enjoy themselves. It was, therefore, with a very rueful air that he replied, 'Why, I suppose I must.'

'Ain't the gentleman a shot, sir?' inquired the long gamekeeper.

'No,' replied Wardle; 'and he's lame besides.'

'I should very much like to go,' said Mr. Pickwick, 'very much.'

There was a short pause of commiseration.

'There's a barrow t'other side the hedge,' said the boy. 'If the gentleman's servant would wheel along the paths, he could keep nigh us, and we could lift it over the stiles and that.'

'The very thing,' said Mr. Weller, who was a party interested, inasmuch as he ardently longed to see the sport. 'The wery thing. Well said, Smallcheck; I'll have it out in a minute.'

But here a difficulty arose. The long gamekeeper resolutely *protested against* the introduction into a shooting party, of a

gentleman in a barrow, as a gross violation of all established rules and precedents. It was a great objection, but not an insurmountable one. The gamekeeper having been coaxed and fed, and having, moreover, eased his mind by 'punching' the head of the inventive youth who had first suggested the use of the machine, Mr. Pickwick was placed in it, and off the party set; Wardle and the long gamekeeper leading the way, and Mr. Pickwick in the barrow, propelled by Sam, bringing up the rear.

'Stop, Sam!' said Mr. Pickwick, when they had got half across the first field.

'What's the matter now?' said Wardle.

'I won't suffer this barrow to be moved another step,' said Mr. Pickwick resolutely, 'unless Winkle carries that gun of his in a different manner.'

'How *am* I to carry it?' said the wretched Winkle.

'Carry it with the muzzle to the ground,' replied Mr. Pickwick.

'It's so unsportsmanlike,' reasoned Winkle.

'I don't care whether it's unsportsmanlike or not,' replied Mr. Pickwick; 'I am not going to be shot in a wheelbarrow, for the sake of appearances, to please anybody.'

'I know the gentleman'll put that ere charge into somebody afore he's done,' growled the long man.

'Well, well, I don't mind,' said poor Mr. Winkle, turning his gun-stock uppermost; 'there.'

'Anythin' for a quiet life,' said Mr. Weller, and on they went again.

'Stop!' said Mr. Pickwick, after they had gone a few yards farther.

'What now?' said Wardle.

'That gun of Tupman's is not safe: I know it isn't,' said Mr. Pickwick.

'Eh? what! not safe?' said Mr. Tupman, in a tone of great alarm.

'Not as you are carrying it,' said Mr. Pickwick. 'I am sorry to make any further objection, but I cannot consent to go on, unless you carry it as Winkle does his.'

'I think you had better, sir,' said the long gamekeeper, 'or you're quite as likely to lodge the charge in yourself as in anything else.'

Mr. Tupman, with the most obliging haste, placed his piece in the position required, and the party moved on again; the two amateurs marching with reversed arms, like a couple of privates at a royal funeral. The dogs suddenly came to a dead stop, and the party advancing stealthily a single pace, stopped too.

'What's the matter with the dogs' legs?' whispered Mr. Winkle. 'How queer they're standing.'

'Hush, can't you?' replied Wardle, softly. 'Don't you see, they're making a point?'

'Making a point!' said Mr. Winkle, staring about him, as if he expected to discover some particular beauty in the landscape, which the sagacious animals were calling special attention to. 'Making a point! What are they pointing at?'

'Keep your eyes open,' said Wardle, not heeding the question in the excitement of the moment; 'Now then.'

There was a sharp whirring noise, that made Mr. Winkle start back as if he had been shot himself. Bang, bang, went a couple of guns—the smoke swept swiftly away over the field, and curled into the air.

'Where are they?' said Mr. Winkle, in a state of the highest excitement, turning round and round in all directions. 'Where are they? Tell me when to fire. Where are they? where are they?'

'Where are they!' said Wardle, taking up a brace of birds which the dogs had deposited at his feet. 'Where are they! Why here they are.'

'No, no; I mean the others,' said the bewildered Winkle.

'Far enough off, by this time,' replied Wardle, coolly re-loading his gun.

'We shall very likely be up with another covey in five minutes,' said the long gamekeeper. 'If this gentleman begins to fire now, perhaps he'll just get the shot out of the barrel by the time they rise.'

'Ha! ha! ha!' roared Mr. Weller.

'Sam,' said Mr. Pickwick, compassionating his follower's confusion and embarrassment.

'Sir.'

'Don't laugh.'

'Certainly not, sir.' So by way of indemnification, Mr. Weller contorted his features from behind the wheelbarrow, for the exclusive amusement of the boy with the leggings, who thereupon burst into a boisterous laugh, and was summarily cuffed by the long gamekeeper, who wanted a pretext for turning round, to hide his own merriment.

'Bravo, old fellow!' said Wardle to Mr. Tupman; 'you fired that time, at all events.'

'Oh yes,' replied Mr. Tupman, with conscious pride. 'I let it off.'

'Well done. You'll hit something next time, if you look sharp. Very easy, ain't it?'

'Yes, it's very easy,' said Tupman. 'How it hurts one's shoulder, though. It nearly knocked me backwards. I had no idea these small fire-arms kicked so.'

'Ah,' said the old gentleman, smiling; 'you'll get used to

it in time. Now then—all ready—all right with the barrow there ?’

‘All right, sir,’ replied Mr. Weller.

‘Come along, then.’

‘Aye, aye,’ replied Mr. Pickwick, and on they went, as briskly as need be.

‘Keep that barrow back now,’ cried Wardle, when it had been hoisted over a stile, into another field, and Mr. Pickwick had been deposited in it once more.

‘All right, sir,’ replied Mr. Weller, pausing.

‘Now, Winkle,’ said the old gentleman, ‘follow me, softly, and don’t be too late this time.’

‘Never fear,’ said Mr. Winkle. ‘Are they pointing ?’

‘No, no, not now. Quietly now, quietly.’ On they crept, and very quietly they would have advanced, if Mr. Winkle, in the performance of some very intricate evolutions with his gun, had not accidentally fired, at the most critical moment, over the boy’s head, exactly in the very spot where the tall man’s brain would have been, had he been there instead.

‘Why, what on earth did you do that for ?’ said old Wardle, as the birds flew unharmed away.

‘I never saw such a gun in my life,’ replied poor Winkle, looking at the lock, as if that would do any good. ‘It goes off of its own accord. It *will* do it.’

‘Will do it,’ said Wardle, with something of irritation in his manner. ‘I wish it would kill something of its own accord.’

‘It’ll do that afore long, sir,’ observed the tall man, in a low, prophetic voice.

‘What do you mean by that observation, sir ?’ inquired Mr. Winkle, angrily.

‘Never mind, sir, never mind,’ replied the long gamekeeper ; ‘I’ve no family myself, sir ; and this here boy’s mother will get something handsome from Sir Geoffrey, if he’s killed on his land. Load again, sir ; load again.’

‘Take away his gun,’ cried Mr. Pickwick, from the barrow, horror-stricken at the long man’s dark insinuations. ‘Take away his gun, do you hear, somebody ?’

Nobody, however, volunteered to obey the command, and Mr. Winkle, after darting a rebellious glance at Mr. Pickwick, reloaded his gun and proceeded onward with the rest.

We are bound, on the authority of Mr. Pickwick, to state, that Mr. Tupman’s mode of proceeding evinced far more of prudence and deliberation than that adopted by Mr. Winkle. Still, this by no means detracts from the great authority of the latter gentleman on all matters connected with the field ; because, as Mr. Pickwick beautifully observes, it has somehow or other happened, from time immemorial, that many of the

best and ablest philosophers, who have been perfect lights of science in matters of theory, have been wholly unable to reduce them to practice.

Mr. Tupman's process, like many of our most sublime discoveries, was extremely simple. With the quickness and penetration of a man of genius, he had at once observed that the two great points to be attained were—first, to discharge his piece without injury to himself; and, secondly, to do so without danger to the bystanders—obviously, the best thing to do, after surmounting the difficulty of firing at all, was to shut his eyes firmly, and fire in the air.

On one occasion, after performing this feat, Mr. Tupman, on opening his eyes, beheld a plump partridge in the very act of falling to the ground. He was on the point of congratulating Mr. Wardle on his invariable success, when that gentleman advanced towards him, and grasped him warmly by the hand.

'Tupman,' said the old gentleman, 'you singled out that particular bird?'

'No,' said Mr. Tupman—'no.'

'You did,' said Wardle. 'I saw you do it—I observed you pick him out. I noticed you as you raised your piece to take aim; and I will say this, that the best shot in existence could not have done it more beautifully. You are an older hand at this than I thought you, Tupman; you have been out before.'

It was in vain for Mr. Tupman to protest, with a smile of self-denial, that he never had. The very smile was taken as evidence to the contrary; and from that time forth his reputation was established. It is not the only reputation that has been acquired as easily, nor are such fortunate circumstances confined to partridge-shooting.

Meanwhile, Mr. Winkle flashed, and blazed and smoked away, without producing any natural results worthy of being noted down; sometimes expending his charge in mid-air, and at others sending it skimming along so near the surface of the ground, as to place the lives of the two dogs in a rather uncertain and precarious tenure. As a display of fancy shooting it was extremely varied and curious; as an exhibition of firing with any precise object, it was, upon the whole, perhaps, a failure. It is an established axiom that 'every bullet has its billet.' If it apply in an equal degree to shoot, those of Mr. Winkle were unfortunate foundlings, deprived of their natural rights, cast loose upon the world, and billeted nowhere.

'Well,' said Wardle, walking up to the side of the barrow, and wiping the streams of perspiration from his jolly face; 'smoking day, isn't it?'

'It is indeed,' replied Mr. Pickwick. 'The sun is tremendously hot even to me. I don't know how you must feel it.'

'Why,' said the old gentleman, 'pretty hot. It's past twelve, though. You see that green hill, there?'

'Certainly'

'That's the place where we are to lunch; and there's the boy with the basket, punctual as clockwork!'

'So he is,' said Mr. Pickwick, brightening up. 'Good, boy, that. I'll give him a shilling, presently. Now then, Sam, wheel away.'

'Hold on, sir,' said Mr. Weller, invigorated with the prospect of refreshment. 'Out of the way, young leathers. If you wally my precious life, don't upset me, as the gen'leman said to the driver, when they was a carryin' him to Tyburn.' And quickening his pace to a sharp run, Mr. Weller wheeled his master nimbly to the green hill, shot him dexterously out by the very side of the basket, and proceeded to unpack it with the utmost despatch.

PARTNERSHIP WITH TIME.

- (1) A, B, and C enter into a partnership: A puts in £2,400 for 18 months, B £3,700 for 6 months, and C £470 for 18 months; they gain £3,460. What is each one's share of the profit?
- (2) X, Y, Z entered into partnership: X put in £484, Y £710, and Z £1,235; after a time they dissolved partnership. X's money had been in 2 years, Y's 5 years, and Z's 7 years; their gains had amounted to £2,348. How much does each receive?
- (3) Brown, Jones, and Robinson go into partnership: Brown's money is in trade 3 months, and he claims $\frac{1}{10}$ of the gain; Jones's is 9 months in trade; and Robinson's share is £800 for 4 months, and he claims half the profits. How much did Brown contribute?

TRADE WINDS.

(From the 'Physical Geography of the Sea,' by Captain Maury.)

phys'-i-cal, relating to the objects of nature	lab'-or-a-tor-y, a chemist's work-room
pe'-tent, plain, evident	re-com-pound', to unite or combine again
e-con'-o-my, system, regulation, thrifty management	or'-bit, the line described by a revolving planet
in-duc'-tion, the drawing of a conclusion from observation	per-sist'-en-cy, constancy
ax'-is (Gr.), plu. ax'-es, the line, real or imaginary, on which a body revolves	dy-nam'-i-cal, relating to force
	lox-o-dron'-ic, slanting, crosswise, oblique
	vis in-er'-ti-a (Lat.), the force of inertia

THERE is no employment more ennobling to man and his intellect than to trace the evidences of design and purpose, which are visible in many parts of the creation. Hence, to the right-minded mariner, and to him who studies the physical relations of earth, sea, and air, the atmosphere is something

more than a shoreless ocean, at the bottom of which he creeps along. It is an envelope or covering for the distribution of light and heat over the surface of the earth; it is a sewer into which, with every breath we draw, we cast vast quantities of dead animal matter; it is a laboratory for purification, in which that matter is recomposed, and wrought again into wholesome and healthful shapes; it is a machine for pumping up all the rivers from the sea, and for conveying the water from the ocean, to their sources in the mountains; it is an inexhaustible magazine, marvellously stored. Upon the proper working of this machine depends the well-being of every plant and animal that inhabits the earth. How interesting, then, ought not the study of it to be! An examination of the uses which plants and animals make of the air is sufficient to satisfy any reasoning mind in the conviction that when they were created, the necessity of this adaptation was taken into account. The connection between any two parts of an artificial machine that works into each other, does not render design in its construction more patent than is the fact that the great atmospherical machine of our planet was constructed by an architect who designed it for certain purposes; therefore the management of it, its movements, and the performance of its offices, cannot be left to chance. They are, we may rely upon it, guided by laws that make all parts, functions, and movements of this machinery as obedient to order and as harmonious as are the planets in their orbits.

Any examination into the economy of the universe will be sufficient to satisfy the well-balanced minds of observant men that the laws which govern the atmosphere and the laws which govern the ocean are laws which were put in force by the Creator when the foundations of the earth were laid, and that therefore they are laws of order; else, why should the Gulf Stream, for instance, be always where it is, and running from the Gulf of Mexico, and not somewhere else, and sometimes running into it? Why should there be a perpetual drought in one part of the world, and continual showers in another? Or why should the conscious winds ever heed the voice of rebuke, or the glad waves ever 'clap their hands with joy?'

To one who looks abroad to contemplate the agents of nature, as he sees them at work upon our planet, no expression uttered, or act performed by them is without meaning. By such a one, the wind and rain, the vapour and the cloud, the tide, the current, the saltness, and depth, and warmth and colour of the sea, the shade of the sky, the temperature of the air, the tint and shape of the clouds, the height of the tree on the shore, the size of its leaves, the brilliancy of its flowers, each and all *may* be regarded as the exponent of certain physical combinations, and therefore as the expression in which Nature chooses

to announce her own doings, or, if we please, as the language in which she writes down or elects to make known her own laws. To understand that language and to interpret aright those laws is the object of the undertaking which we now have in hand. No fact gathered from such a volume as the one before us can therefore come amiss to those who tread the walks of inductive philosophy; for, in the handbook of nature, every such fact is a syllable; and it is by patiently collecting fact after fact, and by joining together syllable after syllable, that we may finally seek to read aright from the great volume which the mariner at sea as well as the philosopher on the mountain—each sees spread out before him.

There have been examined at the Observatory more than a million of observations on the force and direction of the winds at sea. The discussion of such a mass of material has thrown much light upon the circulation of the atmosphere; for, as in the ocean, so in the air, there is a regular system of circulation. Before we proceed to describe this system, let us point out the principal belts or bands of wind that actual observation has shown to exist at sea, and which with more or less distinctness of outline, extend to the land also, and thus encircle the earth. If we imagine a ship to take her departure from Greenland for the South Shetland Islands, she will, between the parallels of 60° North and South, cross these several bands or belts of winds and calms nearly at right angles, and in the following order. (1) At setting out she will find herself in the region of south-west winds, or counter-trades of the north—called counter, because they blow in the direction whence come the trade-winds of their hemisphere. (2) After crossing 50°, and until reaching the parallel of 35° N., she finds herself in the belt of westerly winds, a region in which winds from the south-west and winds from the north-west contend for the mastery, and with nearly equal persistency. (3) Between 35° and 30°, she finds herself in a region of variable winds and calms; the winds blowing all around the compass, and averaging about three months from each quarter during the year. Our fancied ship is now in the 'horse-latitudes.' Hitherto winds with westing in them have been most prevalent; but, crossing the calm belt of Cancer, she reaches latitudes where winds with easting become most prevalent. (4) Crossing into these, she enters the region of north-east trades, which now become the prevailing winds until she reaches the parallel of 10° N., and enters the equatorial calm belt, which, like all the other wind-bands, holds fluctuating limits. (5) Crossing the parallel of 50° N., she enters where the south-east trades are the prevailing winds, and so continues until the parallel of 30° S. is reached. (6) Here is the calm belt of Capricorn, where, as in that of

Cancer, she again finds herself in a region of shifting light airs, and calms, and where the winds with westing in become the prevailing winds. (7) Between the parallels 35° and 40° S., the north-west and south-west winds co with equal power for the mastery. (8) Crossing 40° counter-trades,—the north-west winds of the southern sphere,—become the prevailing winds, and so remain, as our observations at sea extend towards the south pole.

Such are the most striking movements of the wind the surface of the sea. But, in order to treat of the general system of atmospherical circulation, we should consider those agents reside which impart to that system its general force. They evidently reside near the equator on one side, and about the poles on the other. Therefore instead of confining our attention to the winds at the surface and their relative prevalence from each one of the four quarters, we direct our attention to the upper and lower currents, and the general movements back and forth between the equator and the poles, we shall be enabled the better to understand the general movements of this grand machine.

Thus treating the subject, observations show that from a parallel of about 30° or 35° North and South to the equator have, extending entirely around the earth, two zones of perpetual winds, viz., the zones of north-east trades on this side and of south-east on that. With slight interruptions, these winds blow perpetually, and are as steady and as constant as the currents of the Mississippi River, always moving in the same direction, except when they are turned aside by a mountain or a rainy region here and there to blow as monsoons, land and sea breezes. As these two main currents of air are constantly flowing from the poles towards the equator, we are safe in assuming that the air which they keep in motion must return by some channel to the place toward the poles where it came, in order to supply the trades. If this were not the case, these winds would soon exhaust the polar regions of the atmosphere, and pile it up about the equator, and then cease to exist for the want of air to make more wind of.

This return current, therefore, must be in the upper regions of the atmosphere, at least until it passes over those parallels between which the trade winds are usually blowing on the surface. The return current must also move in the direction opposite to that wind the place of which it is intended to supply. These direct and counter currents are also made to move in a sort of spiral or loxodromic curve, turning to the right as they go from the poles to the equator, and in the opposite direction as they move from the equator towards the poles. This turning is caused by the rotation of the earth on its axis.

The earth, we know, moves from west to east. Now if we imagine a particle of atmosphere at the north pole, where it is at rest, to be put in motion in a straight line towards the equator, we can easily see how this particle of air, coming from the very axis of diurnal rotation, where it did not partake of the diurnal motion of the earth, would, in consequence of its *vis inertiae*, find, as it travels south, the earth slipping from under it, as it were, and thus it would appear to be coming from the north-east, and going towards the south-west; in other words, it would be a north-east wind. The better to explain, let us take a common terrestrial globe for the illustration. Bring the island of Madeira, or any other place about the same parallel, under the brazen meridian; put a finger of the left hand on the place; then moving the finger down along the meridian to the south, to represent the particle of air, turn the globe on its axis from west to east, to represent the diurnal rotation of the earth, and when the finger reaches the equator, stop. It will now be seen that the place on the globe under the finger is to the southward and westward of the place from which the finger started; in other words, the track of the finger over the surface of the globe, like the track of the particle of air upon the earth, has been from the northward and eastward. On the other hand, we can perceive how a like particle of atmosphere that starts from the equator, to take the place of the other at the pole, would, as it travels north, and in consequence of its *vis inertiae*, be going towards the east faster than the earth. It would therefore appear to be blowing from the south-west, and going towards the north-east, and exactly in the opposite direction to the other. Writing south for north, the same takes place between the south pole and the equator.

Such is the process which is actually going on in nature; and if we take the motions of these two particles as the type of the motion of all, we shall have an illustration of the great currents in the air, the equator being near one of the nodes, and there being at least two systems of currents, an upper and an under, between it and each pole.

INVOLUTION.

- (1) What is the square of 384?
- (2) Find the square of 873.
- (3) What is the value of 1786^2 ?
- (4) What is the fifth power of 7?
- (5) Find the cube of 987.
- (6) Find the square of $\cdot 2$.
- (7) What is the cube of $\cdot 1$?
- (8) Find the square of $\frac{1}{2}$.
- (9) Add together the squares of $\frac{1}{4}$, $\frac{2}{5}$, $\frac{3}{20}$, and $\cdot 01$, and express the result decimally.

KING CHARLES II. IN THE OAK.

(From the 'History of the Great Rebellion,' by Lord Clarendon.)

el-quip-age, the furniture of a horseman;
 attendance
 dis-cern', to see clearly
 de-sign'-ed, intended for a particular
 purpose

fi-del'-i-ty, faithfulness
 sus'-ten-ance, food, support
 ap-pre-hen'-sion, fear; expectation of
 trouble

[Edward Hyde, Lord Clarendon, was Chancellor of the Exchequer in the reigns of Charles I. and Charles II., having accompanied the latter in his exile during the Protectorate of Cromwell. His chief work is the 'History of the Great Rebellion,' the events of which were either witnessed by himself or communicated by Charles II. He was afterwards ungratefully treated by the latter, and died in exile at Rouen, 1674, in the sixty-fifth year of his age.]

THOUGH the king could not get a body of horse to fight, he could have too many to fly with him; and he had not been many hours from Worcester, when he found about him near, if not above, four thousand of his horse. There was David Leslie with all his own equipage, as if he had not fled upon the sudden; so that good order, and regularity, and obedience, might yet have made a retreat even into Scotland itself. But there was paleness in every man's looks, and jealousy and confusion in their faces; and scarce anything could worse befall the king than a return into Scotland, which yet he could not reasonably promise to himself in that company. But when the night covered them, he found means to withdraw himself with one or two of his own servants, whom he likewise discharged when it begun to be light; and after he had made them cut off his hair, he betook himself alone into an adjacent wood, and relied only upon Him for his preservation who alone could, and did, miraculously deliver him.

When the darkness of the night was over, after the king had cast himself into that wood, he discerned another man, who had gotten upon an oak in the same wood, near the place where the king rested himself, and had slept soundly. The man upon the tree had first seen the king, and knew him, and came down to him, and was known to the king, being a gentleman of the neighbour county of Stafford, who had served his late majesty during the war, and had now been one of the few who resorted to the king after his coming to Worcester. His name was Careless, who had had a command of foot, about the degree of a captain, under the Lord Loughborough. He persuaded the king, since it could not be safe for him to go out of the wood, and that, as soon as it should be fully light, the wood itself would probably be visited by those of the country, who would be searching to find those whom they might make prisoners, that he would get up into that tree where he had

been, where the boughs were so thick with leaves that a man would not be discovered there without a narrower inquiry than people usually make in places which they do not suspect. The king thought it good counsel, and, with the other's help, climbed into the tree, and then helped his companion to ascend after him, where they sat all that day, and securely saw many who came purposely into the wood to look after them, and heard all their discourse, how they would use the king himself if they could take him. This wood was either in or upon the borders of Staffordshire; and though there was a highway near one side of it, where the king had entered into it, yet it was large, and all other sides of it opened amongst enclosures, and Careless was not unacquainted with the neighbour villages; and it was a part of the king's good fortune that this gentleman, by being a Roman Catholic, was acquainted with those of that profession of all degrees, who had the best opportunities of concealing him; for it must never be denied, that some of that religion had a very great share in his majesty's preservation.

The day being spent in the tree, it was not in the king's power to forget that he had lived two days with eating very little, and two nights with as little sleep; so that, when the night came, he was willing to make some provision for both; and he resolved, with the advice and assistance of his companion, to leave his blessed tree; and, when the night was dark, they walked through the wood into those enclosures which were farthest from any highway, and making a shift to get over hedges and ditches, after walking at least eight or nine miles, which were the more grievous to the king by the weight of his boots (for he could not put them off when he cut off his hair, for want of shoes), before morning they came to a poor cottage, the owner whereof, being a Roman Catholic, was known to Careless. He was called up, and as soon as he knew one of them, he easily concluded in what condition they both were, and presently carried them into a little barn full of hay, which was a better lodging than he had for himself. But when they were there, and had conferred with their host of the news and temper of the country, it was agreed that the danger would be the greater if they stayed together; and, therefore, that Careless should presently be gone, and should, within two days, send an honest man to the king, to guide him to some other place of security; and in the meantime his majesty should stay upon the hay-mow. The poor man had nothing for him to eat, but promised him good butter-milk; and so he was once more left alone, his companion, how weary soever, departing from him before day, the poor man of the house knowing no more than that he was a friend of the captain's, and one of

those who had escaped from Worcester. The king slept very well in his lodging, till the time that his host brought him a piece of bread, and a great pot of butter-milk, which he thought the best food he ever had eaten. The poor man spoke very intelligently to him of the country, and of the people who were well or ill-affected to the king, and of the great fear and terror that possessed the hearts of those who were best affected. He told him, 'that he himself lived by his daily labour, and that what he had brought him was the fare he and his wife had; and that he feared, if he should endeavour to procure better, it might draw suspicion upon him, and people might be apt to think he had somebody with him that was not of his own family. However, if he would have him get some meat, he would do it; but if he could bear this hard diet, he should have enough of the milk, and some of the butter that was made with it.' The king was satisfied with his reason, and would not run the hazard for a change of diet; desired only the man 'that he might have his company as often and as much as he could give it him,' there being the same reason against the poor man's discontinuing his labour, as the alteration of his fare.

After he had rested upon this hay-mow and fed upon this diet two days and two nights, in the evening before the third night, another fellow, a little above the condition of his host, came to the house, sent from Careless, to conduct the king to another house, more out of any road near which any part of the army was like to march. It was above twelve miles that he was to go, and he was to use the same caution he had done the first night, not to go in any common road, which his guide knew well how to avoid. Here he new dressed himself, changing clothes with his landlord; he had a great mind to have kept his own shirt; but he considered, that men are not sooner discovered by any mark in disguises than by having fine linen in ill clothes; and so he parted with his shirt too, and took the same his poor host had then on. Though he had foreseen that he must leave his boots, and his landlord had taken the best care he could to provide an old pair of shoes, yet they were not easy to him when he first put them on, and, in a short time after, grew very grievous to him. In this equipage he set out from his first lodging in the beginning of the night, under the conduct of this guide, who guided him the nearest way, crossing over hedges and ditches, that they might be in least danger of meeting passengers. This was so grievous a march, and he was so tired, that he was even ready to despair, and to prefer being taken and suffered to rest, before purchasing his safety at that price. His shoes had, after a few miles, hurt him so much, that he had thrown them away, and walked the rest of the way in his ill stockings, which were

quickly worn out; and his feet, with the thorns in getting over hedges, and with the stones in other places, were so hurt and wounded, that he many times cast himself upon the ground, with a desperate and obstinate resolution to rest there till the morning, that he might shift with less torment, what hazard soever he run. But his stout guide still prevailed with him to make a new attempt, sometimes promising that the way should be better, and sometimes assuring him that he had but little farther to go; and in this distress and perplexity, before the morning they arrived at the house designed; which, though it was better than that which he had left, his lodging was still in the barn, upon straw instead of hay, a place being made as easy in it as the expectation of a guest could dispose it. Here he had such meat and porridge as such people use to have, with which, but especially with the butter and the cheese, he thought himself well feasted; and took the best care he could to be supplied with other, little better shoes and stockings; and after his feet were enough recovered that he could go, he was conducted from thence to another poor house, within such a distance as put him not to much trouble; for having not yet in his thought which way or by what means to make his escape, all that was designed was only, by shifting from one house to another, to avoid discovery. And being now in that quarter which was more inhabited by the Roman Catholics than most other parts in England, he was led from one to another of that persuasion, and concealed with great fidelity. But he then observed that he was never carried to any gentleman's house, though that country was full of them, but only to poor houses of poor men, which only yielded him rest with very unpleasant sustenance; whether there was more danger in those better houses, in regard of the resort and the many servants, or whether the owners of great estates were the owners likewise of more fears and apprehensions.

EVOLUTION TO THE SECOND POWER OR SQUARE ROOT.

- (1) Find the square root of 64009.
- (2) What is the square root of 108900?
- (3) What number multiplied once by itself will give 998001?
- (4) Find the square root of 999.
- (5) Find the square root of $\frac{49}{16}$.
- (6) What is the square root of .1?

FIRE.

(From the 'Museum of Science and Art,' by Dr. Lardner.)

ev-o-lu'-tion, the act of unfolding
het-e-ro-gé-ne-ous, dissimilar; of a
different kind or nature
a'-sote, nitrogen gas
in-can-des'-cent, burning

no-men'-cla-ture, the names of things in
any art or science
con-cent'-trate, to drive to a common
centre; to bring into a narrow com-
pass

In the physical theory which prevailed among the ancients, and which maintained its ground for several thousand years, fire was accounted as one of the elements; that is to say, as a material essence, which with three others, air, water, and earth, constituted all natural bodies.

It was only towards the close of the last century, and within the lifetime of the elder part of the present generation, that the true character of fire was discovered.

It is now known that fire is neither a distinct substance nor essence, as supposed by the ancients. It is a phenomenon consisting of the sudden and abundant evolution of heat and light produced when a certain class of bodies called COMBUSTIBLES enter into chemical combination with the oxygen gas, which constitutes one of the constituents of the atmosphere. The term COMBUSTION in the modern nomenclature of physics has been adopted to express this phenomenon.

The class of combustible substances which are commonly used for the production of artificial heat is called FUEL. Such, for example, are pit coal, charcoal, and wood.

Another class of combustibles is used for the production of artificial light: such, for example, are oil, wax, and the gas extracted from certain sorts of pit coal, from oil, and from certain sorts of wood, such as the pitch pine.

The principal constituents of all these combustibles, whether used for the production of heat or light, are those denominated by chemists CARBON and HYDROGEN.

CARBON is the name given to charcoal when it is absolutely pure, which it never is as it is obtained by the ordinary industrial processes. It is in that state combined with various heterogeneous and incombustible substances. In the laboratories of chemists it is separated from these, and obtained in a state of perfect purity, being there distinguished from the charcoal of commerce by the name of carbon.

Carbon having never been resolved by any chemical agent into other constituents, is classed in physics as a simple and elementary body, which enters largely into the composition of a most numerous class of bodies which are found in nature,

or produced in the processes of industry, the sciences, and the arts.

HYDROGEN, like carbon, is classed as a simple and elementary substance; and also, like carbon, enters largely into the composition of a numerous class of bodies.

A quantity of charcoal being placed in a furnace through which a draught of air is maintained, if a part of it be heated to redness, the entire mass will soon become incandescent, and will emit a reddish light, which will be whiter as the air is passed through it more briskly, and will emit considerable heat. The charcoal will gradually decrease in quantity, and at length will disappear altogether from the furnace, under which a small portion of ashes consisting of incombustible matter will remain. If the charcoal had been pure—that is, if it had been carbon—it would have altogether disappeared, no ash whatever remaining.

This phenomenon is an example of FIRE. The heat and light developed during the process here described are commonly called fire.

To comprehend what takes place in this process, we must consider that, as the air passes through the charcoal, the oxygen gas, which forms one-fifth part of it, enters into combination with the pure carbon. A compound is thus formed consisting of carbon and oxygen. The formation of this compound is attended with so great a production of heat, that not only the compound itself, but the charcoal, from which it is evolved, is raised to a very elevated temperature.

The compound thus produced is a gas called carbonic acid. The air which enters the furnace being a mixture of azote and oxygen, that which rises from it after the combustion has been produced is a mixture of azote and carbonic acid; the azote having passed through the furnace without suffering other change than an increase of temperature, while the oxygen has been converted into highly heated carbonic acid. Several questions, however, arise out of this explanation. How is it known that such combination really takes place between the carbon and oxygen? If it do, in what proportion do they combine? How does it appear that the azote, which forms four-fifths of the air which passes through the furnace, issues unaltered?

To supply satisfactory answers to these questions, it is only necessary to bring the two constituents of common air separately into the presence of carbon under the conditions necessary to favour combination, and to ascertain their weights before and after the development of the phenomena.

Let a glass flask containing sixteen grains of oxygen gas be inverted over mercury, and let a piece of carbon weighing

more than six grains, supported in a platinum spoon, be introduced into it by means of a piece of bent platinum wire; let the sun's rays, concentrated by means of a burning glass, be then directed upon the carbon through the glass flask. The carbon will be ignited by the solar heat, and will burn in the oxygen with great splendour.

When the combustion has ceased, and the gas contained in the flask has cooled, it will be found that the mercury in the neck of the flask will stand at exactly the same elevation as it did before the combustion. The gas contained in the flask has therefore the same volume as before, nevertheless it is easy to show that it is by no means the same gas.

In the first place, if it be weighed, it will be found to weigh 22 grains instead of 16 grains; and if the unburned residue of the carbon be weighed, its weight will be found to be 6 grains less than it was before the experiment. The inference is, that 6 grains of the carbon have combined with the 16 grains of the oxygen previously contained in the flask, but that in thus combining, the carbon has not made any change in the volume of the gas. If the gas contained in the flask be examined by the usual tests, it will immediately appear that it is no longer oxygen. No combustible will burn in it, and it will not support life by respiration. In fire, it will be found to be identical with the noxious gas, called choke-damp, and to possess all the chemical characters of the gas called CARBONIC ACID.

If the same flask, similarly filled with nitrogen gas or azote, be submitted to a like experiment, the result will not be the same. The solar rays concentrated on the charcoal will still render it red hot, but it will not burn nor undergo any other change. On removing the focus of solar rays from it, it will become gradually cool, and when removed from the flask will have the same weight as when introduced into it. The azote which fills the flask will also be found to be unaltered.

It follows, therefore, that the FIRE produced when carbon burns in common air is nothing more than the heat and light developed in the formation of carbonic acid, by the combination of the carbon with the oxygen of the surrounding air, and that these substances combine in the proportion of 6 parts by weight of carbon to 16 of oxygen.

It has been already shown that hydrogen combines with oxygen in the proportion of 1 part by weight of the former to 8 of the latter to form water, and that if the combination be formed in a pure or nearly pure atmosphere of the gases it is instantaneous and accompanied by an explosion. If, however, the combination takes place, as it may, in common air, the phenomena will be very different.

If pure hydrogen, compressed in a bladder or other reservoir

be allowed to issue from a small aperture, a light applied to it will cause it to be inflamed. It burns tranquilly without explosion, producing a pale yellowish flame and very feeble light, but intense heat. This is the effect attending the gradual and continual combination of the hydrogen, as it escapes from the aperture, with the oxygen of the surrounding air. It may be asked why the hydrogen issuing from the aperture does not combine with the oxygen of the air without the application of a flame to it? And also, why being once inflamed by the application of such a body, its continued application becomes unnecessary? These questions are easily resolved. The hydrogen has an affinity or attraction for oxygen, which is not strong enough to cause their combination at common temperatures, but when the temperature of the hydrogen is greatly elevated, its attraction for the oxygen becomes so exalted, that it enters into instant and spontaneous combination with it. Now by applying the flame of a lamp or candle, or any other burning body, to the jet of hydrogen, its temperature becomes so greatly raised, and its attraction for oxygen consequently so exalted, that it enters directly into combination with the oxygen of the air which is in immediate contact with it at the moment.

But it is also asked, how the continuance of the combination and the consequent maintenance of the flame takes place—the candle or lamp which produced its commencement being withdrawn? This is explained by the great quantity of heat produced by the combination of the hydrogen with the oxygen. The commencement of the combination being produced by the candle or lamp, the hydrogen and oxygen themselves in the act of combining develop an intense heat, and the succeeding portion of hydrogen gas being in contact with them becomes heated, and combines like the former with a fresh portion of oxygen. In the same manner, the heat developed by these being shared by the succeeding portion of gas, a further combination and development of heat takes place, and so on. Thus the combination being once commenced, the heat necessary for its maintenance and continuity is developed in the process itself, which accordingly goes on without the necessity of being again kindled by the application of any flame. The continuance of the combustion of carbon, whether in pure oxygen gas or in common air, is explained in the same manner.

The combustion of carbon differs from that of hydrogen in this, that the former takes place without the production of *flame*. The charcoal being heated to redness, and still in the solid form, enters directly into combination with the oxygen of the surrounding air, and the carbonic acid which is formed being a gas which is not luminous nor visible, the carbon disappears. But in the case of hydrogen, the heat produced by

the combustion is so intense as to render the gas itself luminous, just as intense heat will render a mass of iron red-hot or white hot. When gas becomes thus luminous it is called *flame*.

EVOLUTION TO THE THIRD POWER OR CUBE ROOT.

- (1) Find the cube root of 729.
- (2) What number multiplied twice by itself will give 490399 ?
- (3) Find the cube root of 929714176.
- (4) Find the cube root of 2.
- (5) What is the cube root of .2 ?
- (6) Find the cube root of $37\frac{1}{4}$.
- (7) Find the cube root of 1.

SELECTIONS FROM THE POEMS OF GRAY, GOLDSMITH, CHATTERTON, AND BEATTIE.

THE BARD.

(Thomas Gray)

[Born, 1716; died, 1771. Poems: 'Ode to Eton College,' 'Elegy written in a Country Churchyard,' 'The Progress of Poesy,' 'The Bard,' 'Ode to Adversity,' &c.]

tis'-sue, cloth interwove with gold or silver
warp (n.), a thread that runs lengthwise in a loom
woof (n.), threads that cross the warp
ob'-se-ques, funereal solemnities
em'-bry-o, the rudiments or first parts of an animal or plant

rat'-i-fy, to confirm
round'-e-lay, an ancient ballad or poetical composition
gar'-ish, gaudy, showy
sym-pho'-ni-ous, sounding sweetly together
phil-o-me'-la, the Latin for nightingale
in-thral', to enslave

The following ode is founded on the tradition that Edward I., to complete the conquest of Wales, ordered all the bards to be destroyed.

'RUIN seize thee, ruthless king!

Confusion on thy banners wait;

Though fanned by conquest's crimson wing,

They mock the air with idle state.

Helm, nor hauberk's twisted mail,

Nor e'en thy virtues, tyrant, shall avail

To save thy secret soul from nightly fears,

From Cambria's curse, from Cambria's tears!

Such were the sounds that o'er the crested pride

Of the first Edward scattered wild dismay,

As down the steep of Snowden's shaggy side

He wound with toilsome march his long array.

Stout Glo'ster stood aghast in speechless trance:

To arms! cried Mortimer, and couched his quivering lance.

On a rock, whose haughty brow
 Frowns o'er old Conway's foaming flood,
 Robed in the sable garb of wo,
 With haggard eyes the poet stood
 (Loose his beard and hoary hair
 Streamed, like a meteor, to the troubled air);
 And, with a master's hand, and prophet's fire,
 Struck the deep sorrows of his lyre.
 'Hark how each giant oak and desert cave
 Sighs to the torrent's awful voice beneath!
 O'er thee, O king! their hundred arms they wave,
 Revenge on thee in hoarser murmurs breathe;
 Vocal no more, since Cambria's fatal day,
 To high-born Hoel's harp, or soft Llewellyn's lay.

'Cold is Cadwallo's tongue,
 That hushed the stormy main:
 Brave Urien sleeps upon his craggy bed:
 Mountains, ye mourn in vain
 Modred, whose magic song
 Made huge Plinlimmon bow his cloud-topped head.
 On dreary Arvon's shore they lie,
 Smeared with gore, and ghastly pale:
 Far, far aloof the affrighted ravens sail;
 The famished eagle screams, and passes by.
 Dear lost companions of my tuneful art,
 Dear as the light that visits these sad eyes,
 Dear as the ruddy drops that warm my heart,
 Ye died amidst your dying country's cries——
 No more I weep. They do not sleep.
 On yonder cliffs, a grisly band,
 I see them sit; they linger yet,
 Avengers of their native land:
 With me in dreadful harmony they join,
 And weave with bloody hands the tissue of thy line.

'Weave the warp, and weave the woof,
 The winding-sheet of Edward's race.
 Give ample room, and verge enough
 The characters of hell to trace.
 Mark the year, and mark the night,
 When Severn shall re-echo with affright
 The shrieks of death, through Berkley's roof that ring,
 Shrieks of an agonising king!
 She-wolf of France, with unrelenting fangs,
 That tear'd the bowels of thy mangled mate,
 From thee be born, who o'er thy country hangs
 The scourge of Heaven! What terrors round him wait!

Amazement in his van, with Flight combined,
And Sorrow's faded form, and Solitude behind.

'Mighty victor, mighty lord,
Low on his funeral couch he lies !
No pitying heart, no eye afford
A tear to grace his obsequies.
Is the sable warrior fled ?
Thy son is gone. He rests among the dead.
The swarm, that in thy noontide beam were born ?
Gone to salute the rising morn.
Fair laughs the morn, and soft the zephyr blows,
While proudly riding o'er the azure realm,
In gallant trim the gilded vessel goes :
Youth on the prow, and Pleasure at the helm :
Regardless of the sweeping whirlwind's sway,
That, hushed in grim repose, expects his evening prey.

'Fill high the sparkling bowl,
The rich repast prepare ;
Reft of a crown, he yet may share the feast :
Close by the regal chair
Fell Thirst and Famine scowl
A baleful smile upon their baffled guest.
Heard ye the din of battle bray,
Lance to lance, and horse to horse ?
Long years of havoc urge their destined course,
And through the kindred squadrons mow their way.
Ye towers of Julius, London's lasting shame,
With many a foul and midnight murder fed,
Revere his consort's faith, his father's fame,
And spare the meek usurper's holy head !
Above, below, the rose of snow,
Twined with her blushing foe, we spread :
The bristled boar, in infant gore
Wallows beneath the thorny shade.
Now, brothers, bending o'er the accursed loom,
Stamp we our vengeance deep, and ratify his doom.

'The verse adorn again
Fierce War, and faithful Love,
And Truth severe, by fairy Fiction dressed.
In buskined measures move
Pale Grief, and pleasing Pain,
With Horror, tyrant of the throbbing breast.
A voice, as of the cherub-choir,
Gales from blooming Eden bear ;
And distant warblings lessen on my ear,

That, lost in long futurity, expire.
 Fond, impious man, think'st thou yon sanguine cloud,
 Raised by thy breath, has quenched the orb of day?
 To-morrow he repairs the golden flood,
 And warms the nations with redoubled ray.
 Enough for me; with joy I see
 The different doom our fates assign.
 Be thine Despair, and sceptred Care;
 To triumph, and to die, are mine.'
 He spoke; and headlong from the mountain's height,
 Deep in the roaring tide he plunged to endless night.

THE VILLAGE PASTOR.

(Oliver Goldsmith.)

[Born, 1728; died, 1774. Chief works—Poems: 'The Traveller,' 'Deserted Village,' 'Retaliation,' and ballads. Numerous prose works, the chief of which are, 'Citizen of the World,' 'Vicar of Wakefield,' and several comedies.]

NEAR yonder copse, where once the garden smiled,
 And still where many a garden-flower grows wild;
 There, where a few torn shrubs the place disclose,
 The village preacher's modest mansion rose.
 A man he was to all the country dear,
 And passing rich with forty pounds a year;
 Remote from towns he ran his godly race,
 Nor e'er had changed, nor wished to change, his place;
 Unskilful he to fawn, or seek for power
 By doctrines fashioned to the varying hour;
 For other aims his heart had learned to prize,
 More bent to raise the wretched than to rise.
 His house was known to all the vagrant train;
 He chid their wanderings, but relieved their pain.
 The long-remembered beggar was his guest,
 Whose beard descending swept his aged breast;
 The ruined spendthrift now no longer proud,
 Claimed kindred there, and had his claims allowed;
 The broken soldier, kindly bade to stay,
 Sat by his fire, and talked the night away;
 Wept o'er his wounds, or tales of sorrow done,
 Shouldered his crutch, and showed how fields were won!
 Pleased with his guests, the good man learned to glow,
 And quite forgot their vices in their woe;
 Careless their merits or their faults to scan,
 His pity gave ere charity began.

Thus to relieve the wretched was his pride,
 And even his failings leaned to virtue's side;
 But in his duty prompt to every call,
 He watched and wept, he prayed and felt for all;
 And, as a bird each fond endearment tries,
 To tempt her new-fledged offspring to the skies,
 He tried each art, reprov'd each dull delay,
 Allured to brighter worlds, and led the way.

Beside the bed where parting life was laid,
 And sorrow, guilt, and pains, by turns dismayed,
 The reverend champion stood. At his control,
 Despair and anguish fled the struggling soul;
 Comfort came down the trembling wretch to raise,
 And his last faltering accents whispered praise.

At church, with meek and unaffected grace,
 His looks adorned the venerable place;
 Truth from his lips prevailed with double sway;
 And fools, who came to scoff, remained to pray.
 The service past, around the pious man,
 With ready zeal, each honest rustic ran:
 Even children followed with endearing wile,
 And plucked his gown, to share the good man's smile:
 His ready smile a parent's warmth expressed,
 Their welfare pleased him, and their cares distressed;
 To them his heart, his love, his griefs were given,
 But all his serious thoughts had rest in heaven.
 As some tall cliff that lifts its awful form,
 Swells from the vale, and midway leaves the storm;
 Though round its breast the rolling clouds are spread,
 Eternal sunshine settles on its head.

The Deserted Village.

THE MINSTREL'S SONG.

(*Thomas Chatterton.*)

Born, 1752, committed suicide, 1770. Poems: 'Bristow Tragedy,' 'The Tragedy of Ella,' 'Ode to Ella,' 'Battle of Hastings,' 'The Tournament,' &c., published under the name of Rowley, and written with antique spelling and phraseology.]

O! SING unto my roundelay;
 O! drop the briny tear with me;
 Dance no more at holiday,
 Like a running river be;
 My love is dead,
 Gone to his death-bed,
 All under the willow-tree.

Black his hair as the winter night,
White his neck as summer snow,
Ruddy his face as the morning light,
Cold he lies in the grave below :
My love is dead,
Gone to his death-bed,
All under the willow-tree.

Sweet his tongue as throstle's note,
Quick in dance as thought was he ;
Deft his tabor ; oudgal stout ;
Oh ! he lies by the willow-tree.
My love is dead,
Gone to his death-bed,
All under the willow-tree.

Hark ! the raven flaps his wing,
In the brier'd dell below ;
Hark ! the death-owl loud doth sing,
To the nightmares as they go.
My love is dead,
Gone to his death-bed,
All under the willow-tree.

See ! the white moon shines on high ;
Whiter is my true love's shroud ;
Whiter than the morning sky,
Whiter than the evening cloud.
My love is dead,
Gone to his death-bed,
All under the willow-tree.

Here, upon my true love's grave
Shall the garish flowers be laid,
Nor one holy saint to save
All the sorrows of a maid.
My love is dead,
Gone to his death-bed,
All under the willow-tree.

With my hands I'll bind the briers,
Round his holy corse to gre ;
Elfin-fairy, light your fires,
Here my body still shall be.
My love is dead,
Gone to his death-bed,
All under the willow-tree.

Come with acorn-cup and thorn,
 Drain my heart's blood all away ;
 Life and all its good I scorn,
 Dance by night, or feast by day.
 My love is dead,
 Gone to his death-bed,
 Under the willow-tree.

Water witches crowned with reytes,
 Bear me to your deadly tide.
 I die—I come—my true-love waits.
 Thus the damsel spake, and died.

Ella.

THE HERMIT.

(James Beattie.)

* [Born, 1735 ; died, 1808. Chief poem : 'The Minstrel.']

At the close of the day, when the hamlet is still,
 And mortals the sweets of forgetfulness prove,
 When nought but the torrent is heard on the hill,
 And nought but the nightingale's song in the grove :
 'Twas thus by the cave of the mountain afar,
 While his harp rung symphonious, a hermit began :
 No more with himself or with nature at war,
 He thought as a sage, though he felt as a man.

' Ah ! why all abandoned to darkness and wo,
 Why, lone Philomela, that languishing fall ?
 For spring shall return, and a lover bestow,
 And sorrow no longer thy bosom enthrall :
 But, if pity inspire thee, renew the sad lay,
 Mourn, sweetest complainer, man calls thee to mourn ;
 O soothe him, whose pleasures like thine pass away ;
 Full quickly they pass—but they never return.

' Now gliding remote on the verge of the sky,
 The moon, half extinguished, her crescent displays :
 But lately I marked, when majestic on high
She shone, and the planets were lost in her blaze.

Roll on, thou fair orb, and with gladness pursue
 The path that conducts thee to splendour again :
 But man's faded glory what change shall renew !
 Ah fool ! to exult in a glory so vain !

'Tis night, and the landscape is lovely no more ;
 I mourn, but, ye woodlands, I mourn not for you ;
 For morn is approaching, your charms to restore,
 Perfumed with fresh fragrance, and glittering with dew :
 Nor yet for the ravage of winter I mourn ;
 Kind Nature the embryo blossom will save.
 But when shall spring visit the mouldering urn !
 O when shall it dawn on the night of the grave !

'Twas thus by the glare of false science betrayed,
 That leads, to bewilder ; and dazzles, to blind ;
 My thoughts wont to roam, from shade onward to shade,
 Destruction before me, and sorrow behind.
 "O pity, great Father of light," then I cried,
 "Thy creature who fain would not wander from Thee !
 Lo, humbled in dust, I relinquish my pride :
 From doubt and from darkness Thou only canst free."

'And darkness and doubt are now flying away,
 No longer I roam in conjecture forlorn.
 So breaks on the traveller, faint, and astray,
 The bright and the balmy effulgence of morn.
 See Truth, Love, and Mercy, in triumph descending,
 And Nature all glowing in Eden's first bloom !
 On the cold cheek of Death smiles and roses are blending,
 And Beauty immortal awakes from the tomb.'

The Minstrel.

DUODECIMALS.

- (1) Multiply 11 ft. 3 in. by 7 ft. 9 in.
 - (2) Find the product of 24 ft. 9 in. and 1 ft. 9 in. 3".
 - (3) Multiply 7 sq. ft. 8 in. 6" by 4 ft. 9 in. 8".
 - (4) Multiply together 51 ft. 7 in.; 2 ft. 1 in.; and 2 ft. 1 in.
 - (5) Express the answers to the above four examples in feet and inches.
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OCEANICA. THE SANDWICH ISLANDS.

(From the 'Sandwich Islands,' by Manley Hopkins.)

e'-qui-poise, equality of weight or force
con-stel-la'-tion, a cluster of fixed stars
di-ag'-o-nal (n.), a line from angle to
angle of a parallelogram
par-al-lel'-o-gram, a four-sided figure,
whose opposite sides are parallel and
equal
ru-di-men'-tar-y, relating to first prin-
ciples, or the beginning of anything
a-bra'-sion, the act of rubbing off
o-a'-sis, a fertile spot in a desert

sub-merge', to put or plunge under
water
hy-dro-graph'-i-cal-ly, with regard to
the description of water
ra'-di-us, the line drawn from the centre
to the circumference of a circle
pro-tract'-ed, lengthened, drawn out
ig'-ne-o-us, consisting of fire
scor'-i-a, plu. scor'-i-se, (Lat.), dross;
the refuse of metal which has passed
through fire

ONE of the latest results of geographical research may be thus stated:—All the continents stretch downwards from the northern pole of our planet, and terminate in points; as if its waters, receding to the south, had left bare at the lower extremities of the land the central ridges only. In the southern hemisphere, islands form a partial equipoise to these continental masses of land, and declare themselves, by several indications, to be peaks of land, once elevated but afterwards submerged by the increased depth of ocean. Islands elevated by volcanic action constitute exceptions to this general formula.

Islands, comparatively few in number, above the tropic of Cancer, stud the southern waters of the world in countless abundance. Group after group spreads onwards like the constellations of the firmament. In size, they vary from the vast mass of Australia, and of Borneo, with its fifty millions of inhabitants,* to a little *pulos* and low lagoon-islands, rising but a few feet above the sea-level.

The whole of this tropical and southern realm of waters has been named Oceanica, and has been divided hydrographically, for convenience of reference, into five districts—as the stars have been mapped out into imaginary figures with corresponding names. The divisions of the Ocean World are the following:—To the eastward, POLYNESIA; comprising the *Sandwich, Marquesas, Society, Harvey, Friendly, New Zealand, and Samoan* groups. To the south, MELANESIA—inhabited by black races; it includes the *Fiji* (or *Feejee*), *New Hebrides* and *Solomon* Archipelagoes, and *New Guinea*. Still more south, AUSTRALASIA—comprehending the great land of *Australia*, and its dependencies. Westward, MALAISIA—embracing the East India Islands, and inhabited principally by the Malay races.

* Its population is so reported by the Bishop of Labuan.

These islands, six thousand in number, contain the largest in the world, with the exception of Australia. Lastly, situated somewhat centrally with respect to the other groups, a region of small isles and islets, fitly named MICRONESIA.

It is proposed in the following pages to give an account of the most northerly cluster of the Polynesian Archipelago, viz. the Hawaiian or Sandwich Islands. And if on close inspection we find reason to remove the place of the islands of the Blest still onward with the retreating horizon, and discover that, amidst natural charms and delicious climate, vice and death and sorrow hold their place, we only confirm the poet's discovery that—

Things which to the world belong,
So false doth sad experience find,
She learns betimes among the throng,
To bound the kingdom to the mind.

But we shall be made acquainted with a very interesting people, evincing an extraordinary aptitude for European civilisation, and possessing 'a government which, youthful as it is, will bear comparison with those of the best-ruled states in Europe.' These islands have, moreover, a special interest to our countrymen at the present moment, inasmuch as, at the invitation of their sovereign, the English Episcopal Church is about to be planted for the first time on their shores;* not merely, it is hoped, to enlighten that immediate spot, but to shed its light across the waters to other island homes.

The importance of the Sandwich Islands, politically and commercially, arises from their particularly central situation. They lie in a diagonal position from south-east to north-west, in a parallelogram rather exceeding one formed by the 19th and 22nd degrees of North latitude, and the 155th and 160th meridians of West longitude; and it will be seen, by reference to a map, that the group is nearly equidistant from the coasts of America and Japan; and that a radius from its centre would touch in succession the shores of Central America, the north-west States, the Russian territory, the Aleutian Archipelago, Japan, the Philippine Islands, Torres' Straits, New Zealand, and the Feejee Islands. And whilst Australia is just beyond the ambit, California and Vancouver's Island are within a shorter distance of the Hawaiian Islands.

Thus they form an oasis in the ocean desert—a stepping-stone between two worlds; and they afford a place of refreshment of the utmost value for merchantmen and the large fleet of whalers in the northern Pacific. Commerce is establishing for itself a new road from east to west, and from west to east, across the

* This was effected.

ocean; and we still wait in expectation to see an opening forced through the Isthmus of Panama, by which ships may sail from sea to sea, carrying on the interchange of human labour and natural production, without the necessity of a protracted voyage round the South American Continent, and consequent exposure in the inclement and dangerous latitudes of Cape Horn. Should the Darien Ship Canal be constructed, the Hawaiian Islands will assume a far greater importance than they have yet had, for they lie in the very path which navigation would then take. 'Even now,' says a recent visitor, 'the islands, on account of their position and the extent of cultivable land they contain, enjoy advantages above any other of the numerous groups which lie scattered over the Pacific Ocean.'

The origin of the islands is clearly volcanic. This tremendous agency, by which they were elevated from the depths of the sea, and which has tossed up mountain peaks in Hawaii 14,000 feet above the water-level, appears to have taken a direction from south-east to north-west; the first exertion of force having been greatest, and diminishing in intensity as it proceeded. Thus Hawaii, the most southerly island, has an area of 4,000 out of 6,000 square miles, the whole superficial contents of the group; and it possesses also the highest elevation; the two mountains Mauna Kea and Mauna Loa being of nearly equal altitude, viz. 14,000 feet. On the side of the latter mountain is situated the great volcanic crater Kilauea. Next in position to Hawaii, is the island of Maui, with an area of 620 miles, and having in its neighbourhood the smaller island of Lanai and Kahoolawe. To the north-west of Maui lies Molokai, a long narrow island extending east and west, formed by a mountain ridge, which runs its whole length. Next comes Oahu, with an area of 530 miles. Nearly two degrees beyond Oahu is situated Kauai, 500 miles in extent. Last in order of the greater islands is Niihau; and farther westward Kaula rises, which, with one or two islets and uninhabited rocks, shows itself the expiring effort of Plutonic energy.

The observation of Mr. Hill led him to an opposite conclusion with regard to the direction and order in which the islands were projected. He is of opinion that Niihau was the first thrown up, and that the volcanic action advanced towards the south-east, and increased in energy till it culminated in Hawaii, the last and largest link of the chain. As the ground of this opinion, he gives the more or less advanced state of the soil, the progress of vegetation, and the cessation or diminution of eruption and earthquakes. Upon all these data he decided *Kauai* to possess the greatest antiquity, and *Hawaii* the least. *He feels his* opinion fortified by the volcanic activity existing

in Hawaii, and by the fact that in 1837 an extraordinary retreat of the sea took place from the shores of that island, followed by a returning wave, indicating great disturbance, and giving rise to the impression that another island was about to rise to the south-east of Hawaii. The phenomena do not appear quite conclusive in establishing the relative dates of the islands. The oldest lava in Hawaii may be, and probably is, overlaid by newer deposits, and thus concealed; and the present volcanic activity may only show that the original seat of energy remains unchanged; and that the action, greatest at Hawaii, expanded itself in a north-west direction, its last result being the rudimentary island of Niihau, and the rock called Bird Island.

The volcanic, though it is the primary, is not the sole origin of the group. From the flanks of the submerged mountains the coral insect builds upwards its wonderful structure, till it emerges from the waves as a reef, more or less distant from the shore. The antiquity of the islands is shown by their coralline formations, which could only have attained their present elevation by the incessant labours of an infinitude of insects, acting through vast periods of time. In some places there is a double reef; the outer line indicating, perhaps, the slow upheaving of the base of the mountains from the sea-bottom subsequently to its first projection, until it approached sufficiently near the surface of the water to fulfil the conditions necessary to insect existence. The coral reefs of the Hawaiian Islands are, however, of much smaller extent than those of more southern groups, and only appear on some of the coasts.

As might be supposed from the igneous origin of the islands, no metals are found on them. Scorise, decomposed lava, with sand, &c., are the materials of the soil; but ledges of compact limestone are found at considerable elevations above the sea; portions of the bottom of the ocean, probably forced upwards by the great submarine eruptions which have produced the lofty craters which abound. There is also found on the shore a species of white stone, which, from the description received of it, would seem to be analogous to the English 'clunch,' used in the restoration of Ely Cathedral; which, from the ease with which it is worked, is very valuable for carved tracery. This stone, found in the districts of Ewa and Waianae, island of Oahu, is soft whilst lying in the water or under the sand, and easily cut, but hardens by exposure to the sun. For building purposes there are basalt, compact lava, coral rock, and sandstone.

The regions of fertility lie at the bases of the mountains and in the valleys, where abrasion and disintegration have proceeded for untold years, and rich deposits of vegetable mould have accumulated. Such a valley runs up from the capital, Honolulu, among the hills; and from the beautiful views it

affords—its grassy slopes, its bridged rivulets, its villas, and especially its air, which becomes more invigorating as the road winds upward,—the Nuuanu Valley is one of the favourite rides of the residents of Honolulu.

The soil is generally thin and poor, but this is not universally the case; and it affords fine pasturage. On the 'lands,' or grazing farms, are raised large herds, which supply meat for the whalers and merchant-shipping, and thus find a ready market. Vast numbers of horses also subsist on the islands, mostly of an inferior kind; and it would be an advantage to the kingdom if four-fifths of them were destroyed. They unnecessarily consume the grass, and break the fences; but horse-riding is a passion with the natives of both sexes.

Some of the islands are well supplied with rivers and streams, particularly Hawaii and Kauai. Along the shore of Hilo, a district of that island, sixty permanent streams of various sizes fall into the sea; whilst their numerous branches and feeders thread the country, and give unrivalled facilities for irrigation.

Large forests abound, very dense, and broken with chasms, ravines, and extinct craters. In making the ascent of the two great mountains in Hawaii, twelve miles of forest have to be passed through.

The great harbour of the group is Honolulu, situated on the south side of Oahu. It is formed by an indentation of the coast, protected by a broad coral reef. The channel through the reef has only twenty-two and a half feet water at its shallowest part; so that, though the harbour is commodious, vessels drawing more than twenty feet are excluded, and lie in the roadstead outside, where there is excellent anchorage, except during a Souther, or 'Kona.' For shipping of less draught, pilots are in attendance, and the vessels either run through the channel on a wind, or, more generally, are towed in. Ships go out of harbour under sail, as for nine months in the year the trade wind is blowing seaward.

MENSURATION.

To find the area of a rectangle, a square, a rhombus, or a rhomboid.

- (1) Find the area of a square whose side is 27 ft.
- (2) What is the area of a rectangle whose length is 8 ft. 5 in. and breadth 4 ft. 7 in.?
- (3) Find the side of a square whose area is 60 ft. 9 in.
- (4) What is the area of a rhomboid whose base is 75 ft. 7 in. and perpendicular height 9 ft. 8 in.?
- (5) Find the area of a rhombus whose side is 57 ft. 9 in. and perpendicular 9 ft. 5 in.
- (6) Find the area of a rectangular field whose length is 6·5 chains and breadth 4·35 chains.
- (7) Express the length, breadth, and area of the field in No. 6 in yards.

THE RYE-HOUSE PLOT, AND THE TRIALS OF RUSSELL AND SIDNEY.

A.D. 1683. The latter part of the reign of Charles II.

(From the 'Popular History of England,' by Charles Knight.)

in-trigu'-er, one who plots
ad'-tion, an inferior party in a state
ad'-vo-ca-ty, the act of pleading
le-giv'-i-mate, lawful
n-surp, to seize and hold in possession
without right
un-os-ten-ta'-tious, modest, without show
or boastfulness

in-dict'-ment, an accusation, a charge
ca-bal' (n.), a private council, an in-
trigue
co-er'-cion, forcible restraint, or check
o'-vert, open, public
com'-pass (v.), to encircle, to obtain
de-po-si'-tion, the act of bearing witness
par-ti'-ci-pa-tor, a partaker

'NOTHING,' say the Memoirs of James,* 'now was wanting to make the king perfectly easy in his affairs but the duke's assistance in the management of them. . . . The discovery of a cursed conspiracy, which in part they had providentially escaped, but still in great measure hung over their heads, hastened the duke's readmission into business for their mutual security.' The providential escape was from the assassination of the king and the duke, which, it was alleged, was intended to be accomplished at Rye House, in Hertfordshire. Keeling, a vintner, communicated to one of the Secretaries of State, that a plot had been devised for engaging forty men to waylay the king and his brother, as they returned from Newmarket, at a farmhouse called the Rye, belonging to Rumbold, a maltster; that the king returning sooner than was expected, that scheme was given up, and a general insurrection was projected by certain eminent persons, amongst whom were the Duke of Monmouth, Lord Essex, Lord Howard of Escrick, and Lord William Russell. Some of the inferior persons accused were first apprehended. The Rye-House Plot was in every mouth. The place was not so well known to Londoners as at the present day, when hundreds of summer holiday-folks go to make merry at the Rye House, on the pleasant banks of the Lea. It was then described as 'a place so convenient for such a villainy as scarce to be found in England; besides the closeness of the way over a river by a bridge, gates to pass, a strong hedge on one side, brick walls on the other.' The Rye-House Plot appears to have been a real conspiracy amongst obscure men. That the Whig

* Duke of York, the King's brother, afterwards James II.

leaders participated in the design of assassination was not considered probable even amongst royalists of the time. Upon the committal to the Tower of Russell, Essex, and Sidney, Evelyn writes, 'The Lords Essex and Russell were much deplored, few believing they had any evil intention against the king or the church. Some thought they were cunningly drawn in by their enemies, for not approving some late counsels and management relating to France, to Popery, to the persecution of the Dissenters, &c.' The Duke of Monmouth, Lord Grey, Sir Thomas Armstrong, and two others, for whose arrest a proclamation was made, escaped. The trials of three minor conspirators were hurried on, and they were convicted on the evidence of their associates. On the 13th of July, Lord Russell was brought to trial. From the first he gave himself up for lost. As he entered the Tower he told his servant Taunton that he was sworn against, and that his enemies would have his life. Taunton hoped that his master's enemies had no such power. 'Yes,' said Russell, 'the devil is loose!'

According to the political creeds of men of a past age, it has been customary to speak of Russell and Sidney as martyrs in the cause of liberty, or as scoundrels who had no just notions of government. To regard the conduct and character of either of these eminent men with enthusiastic admiration, is to us as impossible as to consider them as selfish and ambitious intriguers, ready to plunge the nation into civil war for the advancement of a faction, or the advocacy of a wild theory of a republic. Their notions of a political perfectibility were essentially different. Russell, the calm and practical representative of a great party, sought to attain freedom under a monarchy sufficiently checked by a Parliament, and to exercise religion under a Protestant establishment, tolerant to all forms of dissent but that of Roman Catholicism. Popery was his one great terror, and not unreasonably so. He was violent towards Papists, because he regarded Popery 'as an idolatrous and bloody religion.*' The political principles of Algernon Sidney were essentially different. He was the last of the old Commonwealth-men, of the school of Vane. He hated the legitimate tyranny of Charles as much as he hated the usurped power of Cromwell. He disliked Popery rather with the dislike of the philosopher than that of the Christian. Neither Russell nor Sidney contemplated the removal of political evils by the assassination of the king. When Charles gave for his reason for denying mercy to

* He was their relentless and persecuting enemy, when his party was all powerful, for reasons which he thus expressed:—'As for the share I had in the prosecution of the Popish plot, I take God to witness that I proceeded in it in the sincerity of my heart, being then really convinced, as I am still, that there was a conspiracy against the king, the nation, and the Protestant religion.'

Russell, 'If I do not take his life he will soon have mine,' he was thinking of his father's fate rather than of such danger as that of the Rye House. He told Russell, upon his first examination before the council, that nobody suspected him of any design against his person, but that there was good evidence of his being in designs against his government. Russell was as conscious of his own political importance as Charles was aware that in removing him he removed the great obstacle to the designs which James now steadily advocated with the zeal of a bigot and the blindness of a despot. 'Arbitrary government,' said Russell to his chaplain, Mr. Johnson, 'cannot be set up in England without wading through my blood.' The trial of Russell derives its chief interest from a circumstance which associates it with the tenderness, the devotion, the fortitude of woman. The day before the trial, Lady Russell, the daughter of the Earl of Southampton, wrote a note to her husband in these words:—'Your friends believing I can do you some service at your trial, I am extremely willing to try; my resolution will hold out; pray let yours. But it may be the Court will not let me; however, do you let me try.' On the 13th of July, the forms of indictment having been gone through, and the prisoner having in vain requested a postponement of the trial for a day, that he might produce witnesses not yet arrived, he said, 'May I have somebody to write, to help my memory?' 'Yes, a servant,' was the answer. 'My wife is here to do it.' And so, by her lord's side, sat that noble wife, calmly doing her office amidst the most exciting scenes. Lord Howard of Escrick appears. He was Russell's relative. To save himself, he offered to criminate his friends. He is put in the witness-box. His voice falters. 'We cannot hear you, my lord,' says one of the privy council. Howard explains, 'There is an unlucky accident happened which hath sunk my voice; I was but just now acquainted with the fate of my Lord of Essex.' The news ran through the Court that Essex had committed suicide in the Tower. 'This fatal news coming to Hicks's Hall upon the article of my Lord Russell's trial, was said to have no little influence on the jury and all the bench to his prejudice.'* The Attorney-General said, 'My Lord Russell was one of the council for carrying on the plot with the Earl of Essex, who hath this morning prevented the hand of justice upon himself.' Men doubted whether Essex perished by his own hand. His head was so severed from his body 'that an executioner could hardly have done more with an axe. There were odd reflections upon it.'† The evidence of Howard and

* Evelyn, 'Diary,' July 13.

† Evelyn, 'Diary.'

other witnesses went to show that Russell, before Shaftesbury left the country, had attended a meeting in the city, at which a rising was debated, and there was talk of the feebleness of the king's guard at Whitehall. Howard also asserted that there was a cabal of six persons, Monmouth, Essex, Russell, Sidney, Hampden, and himself; and that one of their objects was to draw the Scotch malcontents to join with them. Russell made a very short defence, in which he solemnly denied the charges imputed to him: 'I have ever looked upon the assassination of any private person as an abominable, barbarous, and inhuman thing, tending to the destruction of all society. How much more the assassination of a prince, which cannot enter into my thoughts without horror and detestation; especially considering him as my natural prince, and one upon whose death such dismal consequences are but too likely to ensue. . . . As for going about to make or raise a rebellion, that likewise is a thing so wicked, and withal impracticable, that it never entered into my thoughts. Had I been disposed to it, I never found, by all my observation, that there was the least disposition or tendency to it in the people. And it is known, rebellion cannot be now made here as in former times, by a few great men.' And yet we cannot doubt that 'a few great men' contemplated some coercion of the government perhaps short of rebellion, despairing of 'having things redressed in a legal parliamentary way.' It is difficult to draw the line between legal and illegal resistance when men are hopeless of just government. Russell was convicted of treason, though certainly he was illegally convicted. He had committed no overt act, imagining the king's death, which had brought him within the Statute of Treason of Edward III. The Act of William and Mary annulling his attainder, says that he was 'by partial and unjust constructions of law, wrongfully convicted, attainted, and executed for high treason.' Russell went to death with Christian fortitude. Extraordinary efforts were made to save his life; but Charles was not to be moved even by the offer of a hundred thousand pounds. Russell was beheaded on the 21st of July, on a scaffold erected in Lincoln's Inn Fields. His parting with his noble wife had something more touching than sobs and tears. 'This flesh you now feel, in a few hours must be cold,' he said. They then kissed and separated, in eloquent silence.

The trial of Algernon Sidney was postponed till the 21st of November. Pemberton was Chief Justice when Russell was tried. He was removed to make room for Jeffreys. Lord Howard of Escrick was again the chief witness against the friend who had confided in the betrayer's professions of republicanism. Two witnesses were required by the Statute of

Treason. There was no second living witness against Sidney; that defect was supplied by a manuscript found amongst Sidney's papers, in which treasonable principles were held to be advocated. He approved of conspiracies against Nero and Caligula, and therefore was ready to compass the king's death. Howard's depositions were different from those which he gave on the trial of Russell. Sidney appealed to the jury whether any credit was due to a man who deceived and betrayed his friends, who had said he could not get his own pardon from the king till he had done 'some other jobs.' Of course Sidney was convicted in the utter absence of all legal evidence of treason. He was brought up for judgment on the 26th. When he heard his sentence he prayed God that, 'if at any day the shedding of blood that is innocent must be revenged, let the weight of it fall only on those that maliciously persecute me for righteousness' sake!' Jeffreys, although he had kept his brutal nature in some subjection to decency, then exclaimed, 'I pray God to work in you a temper fit to go into the other world, for I see you are not fit for this.' Sidney stretched out his arm and said, 'My Lord, feel my pulse, and see if I am disordered.' Evelyn records that on the 5th of December he was at a wedding, where he met Lord Chief Justice Jeffreys and Mr. Justice Withings. 'These great men spent the rest of the afternoon, till eleven at night, in drinking healths, taking tobacco, and talking much beneath the gravity of judges; who had but a day or two before condemned Mr. Algernon Sidney, who was executed the 7th on Tower Hill, on the single witness of that monster of a man, Lord Howard of Escrick, and some sheets of paper taken in Mr. Sidney's study, pretended to be written by him, but not fully proved.' Sidney died with a simple courage and unostentatious composure worthy of his strength of mind. 'When he came on the scaffold, instead of a speech, he told them only that he had made his peace with God; that he came not thither to talk, but to die; put a paper into the sheriff's hand, and another into a friend's; said one prayer as short as a grace; laid down his neck, and bid the executioner do his office.' *

Connected with the other chief participators of the alleged conspiracy, 1683, we may mention that Monmouth was ultimately pardoned; and that Sir Thomas Armstrong was given up by the States of Holland, and executed without a trial upon his sentence of outlawry. He had surrendered within the year, during which the law allows the accused to claim a trial. Jeffreys rudely resisted this legal demand of Armstrong.

* Evelyn, 'Diary.'

MENSURATION.

To find the area of a triangle.

- (1) What is the area of a triangle whose base is 7 ft. 9 in. and perpendicular height 3 ft. 6 in.?
- (2) How many acres are there in a triangular field whose base is 13 chains and perpendicular 10.25 chains?
- (3) If a rectangular field contains 12 acres, what is its breadth, its length being 25 chains?
- (4) How many square yards are there in a triangular field whose base is 13.5 chains and perpendicular 7.68 chains?
- (5) What would be the cost of mowing a rectangular field of grass at 5s. per acre, its length being 24.5 chains and breadth 21.32 chains?

 ATTRACTION.

(From the 'Laboratory of Chemical Wonders,' by G. W. Septimus Piesse.)

co-he'sive, *having the power of sticking*
 in-ſ-tru-ct (v.), *to instruct in rudiments*
 ef-fer-ves-cent, *gently boiling or bub-
 bling*
 vi-cin-i-ty, *neighbourhood*
 de-flect-ed, *turned aside*

cap-il-la-ry, *like a hair, small*
 com-po-nent (n.), *one of the parts of*
which a compound body is formed
 spe-cif-ic, *peculiar*
 co-in-ci-dence, *an event happening at*
the same time with another

If there be any one phenomenon more than another which has puzzled philosophers to explain, it is that which is called 'attraction.' Any attempt to explain it by words involves the necessity of stating that several kinds of powers of attraction are recognised. First may be noticed the attraction of the earth towards all bodies above its surface. That which causes matter to 'tumble' or 'fall down' is called gravitation, or the earth's attraction. Secondly, there is what is termed cohesive attraction, which regulates the form of bodies, whether they be solid, as a rock, or granular, like sand. Another sort of attraction is named affinity, or chemical attraction, which produces all sorts of compounds; such as water, salt, sugar, &c., which are made up of substances of a totally opposite nature, held together by affinity. Were it not for this peculiar attraction of one substance to another, the whole world would be resolved into its elements; nothing would exist but a few metals, three or four gases, some sulphur, and charcoal; but by the force of affinity these different things unite, and produce all the beauties of nature. Thirdly, there is a magnetic attraction, or magnetism—an effect observed in only a very few substances, such as iron, nickel, and cobalt. Lastly, we have capillary attraction. By this force the sap rises in trees: a drop of water at the root finds its

way to the summit of the loftiest poplar. Although we have made these divisions of the various powers which attraction exhibits, yet we are no nearer to the comprehension of the cause which produces the effect. Could we but ascertain the reason why a stone falls towards the earth when released from the hands, it is probable that we should soon discover the cause of the motion of all the heavenly bodies. Could we but suspend and resume the power of gravitation at will, we could travel round the earth in twenty-four hours; we could then rise a little above the earth's surface, and remain like a gossamer in the air; the world would continue to revolve as it now does, upon its axis, at the rate of a thousand miles an hour. This would rapidly bring Africa and Australia under us, and by resuming gravitation we could descend where we pleased. Wonderful as this idea may be to the uninitiated, it is nevertheless not beyond the hope of realisation by many philosophers. This desire is buoyed up by analogy. The law of nature can be overcome and subverted in many ways. For instance, Davy produced the metal potassium from pearlsh by counteracting affinity with a stream of electricity.

AFFINITY ILLUSTRATED.

Affinity, or power of uniting of one substance with another, is so great, that were it not for living plants and animals each element of the world would soon seek out its fondest ally, and, these being united, there would quickly be an end to any further chemical change of matter on the face of the earth. The vital power, however, of living plants and animals is constantly undoing what the inorganic or non-vital materials are ever consummating; the very few native or natural elements that are found by man show how this power has already done its work. Man never finds iron, phosphorus, potassium, carbon, and a host of other materials, in their primitive state, but always combined with some other of the elements: and it is his ingenuity and chemical knowledge which break them up and separate them, giving us iron for the ploughshare, phosphorus for the match, and many other necessities of civilised life. The laws of affinity are best illustrated by many of the events of everyday life, such as the burning of a candle, the decay of wood, the change of lime into chalk, and the rusting of iron. Tallow at the ordinary temperature has but little affinity for the oxygen in the air; it has however sufficient affinity for it, and gradually changes, or becomes, as we say, rancid. The higher the temperature, the greater is this affinity. If tallow be thrown on to hot iron, as in a frying-pan, then a further change is noticed

in the powerful odorous bodies produced. At a burning heat, however, the affinity of the oxygen of the air and the components of the tallow is so great, that the whole disappears in invisible gases. Wood shows a similar action, according to the temperature it is exposed to. If air, wood, and water be exposed together, their mutual affinities are sufficient to sap 'the heart of oak' in a few years; and if heated to the combustion point, this change takes place in a few minutes. If we make a paste of lime and water, and spread it on a tile, and then expose it to the air, in less than a month the carbonic acid which is in the air will unite with the lime and produce chalk. Now, if vinegar be poured on to this chalk, an effervescence is produced by the escape of the carbonic acid; the vinegar (acetic acid) having a greater affinity for the lime than the carbonic acid, throws out the latter. Iron-stone as it is dug from the mine is little else but rust (or oxide) of iron—that is, oxygen from the air united with the metal. The smelter's business is to make the oxygen in the metallic rust unite with the coal, which it readily does at a furnace heat; and thus he shows us how he can break up that affinity which has hidden the bright metal from mortal gaze since the world began. The want of the knowledge of the laws of affinity betokens savage life; on the contrary, a thorough comprehension of affinity indicates a high state of civilisation.

MAGNETISM.

At no great distance from Constantinople is the ancient town of Magnesia, once a city, and the residence of the great Ottoman rulers of the East, and the centre of oriental splendour. A pleasant ride from this old Magnesia brings us to the vicinity of the most remarkable iron mines in the world; remarkable not for the quantity of metal produced, but for the peculiar properties of the ore. The mineral here obtained has the specific name of leadstone, or (as now corrupted) loadstone. If a strip of this stone be balanced on a point, it will turn on that point till it takes a direction which is opposite to the motion of the earth; and as the globe revolves from west to east, so therefore does the loadstone stand in a direction north and south. According both to history and tradition, round and about Magnesia dwelt, at a very remote period, a civilised race. Men of thought and science naturally had their attention directed to the astonishing and almost life-like property of this stone. Nearly all of us have read, or intend to read, the story of Sinbad the Sailor, in the 'Arabian Nights' Entertainments.' *How long ago it is since that tale was written it is difficult to say, but it is certain that it was as popular before the Christian*

era as now. The loadstone of the tale is the Mountain of Adamant, which drew the nails out of the wonderful navigator's ship. We read in the legend, that 'About noon we had come so near that we found what the pilot had foretold to be true, for we saw all the nails and iron in the ship fly towards the mountain by the violence of their attraction, with a horrible noise; so the ship split, and sank into the sea.' Since the Crimean war navigation has been very much extended in the Black Sea, and here is a confirmation of the Arabian fable by a recent traveller. 'Ships have lately run ashore on the coasts of the Black Sea, near Sinope; and the captain of one that narrowly escaped wreck, suspected that the compass had been deflected by magnetic influence. This suspicion led to an investigation, which has issued in the discovery of a valuable mine of iron ore or leadstone on those coasts, the danger of which is calamitous.' Now, if this, or the mines near Magnesia (and both are not far apart), be not the identical Mountain of Adamant referred to by Sinbad, it is certainly a very remarkable coincidence. The power which we call magnetism derives its name from Magnesia, because of this loadstone, and as the subject is an old one, we ought perhaps to know all about it; but nevertheless, it still mystifies the most profound philosophers, and what we do know has been discovered by men of our own age.

As we have before said, if a piece of this adamant, or loadstone, be balanced, it will turn till its direction is north and south, and then remain stationary; but this is not all, for the loadstone has the power to impart the same quality to a piece of steel, which it does by mere friction, losing by the operation not the slightest power itself, yet giving to the steel no less an amount of power than itself possesses; and steel thus treated is said to be magnetised. But this power of placing itself at right angles to the motion of the earth is not the only quality that a magnet possesses. The attractive influence it exercises over iron and steel is no less wonderful, and indeed so much so, that considerable force is necessary to remove the object attracted when once brought in contact with it. A number of mechanicians are now engaged in solving the problem—how to make this power useful for locomotion, and there is great probability that they may eventually succeed. Although we are not able to explain the cause of magnetism, yet we have ascertained that it is intimately connected with electricity, for we can produce the one from the other. The mariner's compass consists of a piece of steel, shaped like an arrow, that has been rubbed with either a loadstone or magnet. When thus treated, it is called a magnetic needle; it is then fixed to a card, on which are marked all the points of the horizon. In this way it

becomes useful to the traveller by land and by sea, as he can direct his course to any point he pleases, knowing well that—

*'The obedient steel with living instinct moves,
And veers for ever to the pole it loves.'*

Hence the old name of leadstone* is correct.

Another remarkable property inherent in the magnet is that of having a power which we call the repulsive or repelling power, which is no less active than its attracting power. If two magnets, with the same lettered points, be placed near together, they instantly move away from each other with considerable force. In this way the chemists have given to the mechanics two horses, one that pulls, and one that pushes; and it is for them to solve the means of harnessing them to the vehicle—a feat probably beyond the horse-taming powers of Mr. Rarey himself. A great number of beautiful magnetic experiments can be made, and, for the purpose of illustration, Mr. Myers, toy merchant, of Leadenhall Street, has constructed a box of magnetic toys. This is accompanied by a little book of explanation, in which the author says, and very wisely, 'There is no reason why a young lady should not study all that is known about this or any other branch of science.' The laws of nature exert their influence on women as well as men, and all alike may suffer from neglecting them; for there is nothing peculiar in a woman's mind which prevents it from acquiring a deeper insight into natural laws, and there is nothing peculiar in a man's mind that he should appropriate this knowledge to himself.

MENSURATION.—PARALLELOGRAMS AND TRIANGLES.

- (1) What is the length in yards of the hedge surrounding a square field whose area is 14 a. 29 p. $6\frac{3}{4}$ yds.?
- (2) If the length of a rectangular court-yard be 100 ft. and its area 538 yds. 8 ft., what is its width?
- (3) What length of carpet 3 qrs. wide will be required to cover the floor of a drawing-room which measures 45 ft. by 25 ft. 6 in.?
- (4) If the area of a triangular field be 12 acres and its base 12 chains, what is the length of its perpendicular?
- (5) A field is cut up into a square whose side is 57 yards, a rectangle 320 yards by 57, and a triangle with base 57 yards and perpendicular 36 yards: find the area of the field.

* Guidance stone.

ON VAPOURING, OR TALKING BIG.

(From 'Recreations of a Country Parson,' by A. K. H. B.)

in-vet'-e-rate, incurable
 et-y-mo-lo'-gi-cal, relating to the deriva-
 tion of words
 av'-em-ue, a walk between two rows of
 trees
 me'-nage (Fr.), a household, an estab-
 lishment
 hand, a measure of four inches
 spar'-in, a disease in the hocks of horses
 cre'-dence, belief

im-pli'-cit, entire, complete
 E'-rin', the native name of Ireland
 senior wrangler, the first man in the first
 class of mathematics at the annual
 examination for honours in the Uni-
 versity of Cambridge
 ni-tor in ad-ver'-sum (Lat.), I struggle
 against adversity
 jeop'-ard-ed, placed in danger

Mr. Boyd, one of the first Essayists of the day, is a Scotch Clergyman. His Essays were first published in 'Fraser's Magazine,' under the above initials, by which he is best known.

It is natural enough to pass from thinking of one human weakness to thinking of another; and certain remarks of a fellow-traveller, not addressed to me, suggest the inveterate tendency to vapouring and big talking which dwells in many men and women. Who is there who desires to appear to his fellow-creatures precisely what he is? I have known such people and admired them, for they are comparatively few. Why does Mr. Smith, when some hundreds of miles from home, talk of his *place in the country*? In the etymological sense of the words it certainly is a place in the country, for it is a seedy one-storied cottage without a tree near it, standing bleakly on a hill-side. But a *place in the country* suggests to the mind long avenues, great shrubberies, extensive greenhouses, fine conservatories, lots of horses, abundance of servants; and that is the picture which Mr. Smith desires to call up before the mind's eye of those whom he addresses. When Mr. Robinson talks with dignity about the political discussions which take place in his *servants' hall*, the impression conveyed is that Robinson has a vast establishment of domestics. A vision rises of ancient retainers, of a dignified housekeeper, of a bishop-like butler, of Jeameses without number, of unstinted October. A man of strong imagination may even think of huntsmen, falconers, couriers—of a grand baronial *ménage*, in fact. You would not think that Robinson's establishment consists of a cook, a housemaid, and a stable-boy. Very well for the fellow too, but why will he vapour? When Mr. Jones told me the other day that something or other happened to him when he was going out 'to the *stables* to look at the *horses*,' I naturally thought, as one fond of horse-flesh, that it would be a fine sight to see Jones's *stables*, as he called them. I thought of three handsome carriage-horses sixteen hands high, a pair of pretty ponies for his wife to drive, some hunters, beauties to look at

and tremendous fellows to go. The words used might even have justified the supposition of two or three racehorses, and several lads with remarkably long jackets walking about the yard. I was filled with fury when I learned that Jones's *horses* consisted of a large brougham horse, broken-winded, and a spavided pony. I have known a man who had a couple of moorland farms habitually talk of his *estate*. One of the commonest and weakest ways of vapouring is by introducing into your conversation, very familiarly, the names of people of rank whom you know nothing earthly about. 'How sad it is,' said Mrs. Jenkins to me the other day, 'about the duchess being so ill! Poor dear thing! *We are all in such great distress about her!*' '*We all*' meant, of course, the landed aristocracy of the district, of which Mrs. Jenkins had lately become a member, Jenkins having retired from the hardware line and bought a small tract of quagmire. Some time ago a man told me that he had been down to Oatmealshire to see his *tenantry*. Of course he was not aware that I knew that he was the owner of just one farm. 'This is my parish we have entered,' said a youth of clerical appearance to me in a railway carriage. In one sense it was; but he would not have said so had he been aware that I knew he was the curate, not the rector. 'How can Brown and his wife get on?' a certain person observed to me; 'they cannot possibly live: they will starve. Think of people getting married with not more than *eight or nine hundred a-year!*' How dignified the man thought he looked as he made the remark! It was a fine thing to represent that he could not understand how human beings could do what he was well aware was done by multitudes of wiser people than himself. 'It is a cheap horse that of Wiggins's,' remarked Mr. Figgins; 'it did not cost more than seventy or eighty pounds.' Poor silly Figgins fancies that all who hear him will conclude that his own broken-kneed hack (bought for 25*l.*) cost at least 150*l.* Oh, silly folk who talk big, and then think you are adding to your importance, don't you know that you are merely making fools of yourselves? In nine cases out of ten the person to whom you are relating your exaggerated story knows what the precise fact is. He is too polite to contradict you and to tell you the truth, but rely on it—he *knows* it. No one believes the vapouring story told by another man; no, not even the man who fancies that his own vapouring story is believed. Everyone who knows anything of the world knows how, by an accompanying process of mental arithmetic, to make the deductions from the big story told, which will bring it down to something near the truth. Frequently has my friend Mr. Snooks told me of the crushing retort by which he shut up Jeffrey upon a memorable occasion. I can honestly declare that I

never gave credence to a syllable of what he said. Repeatedly has my friend Mr. Longbow told me of his remarkable adventure in the Bay of Biscay, when a whale very nearly swallowed him. Never once did I fail to listen with every mark of implicit belief to my friend's narrative, but do you think I believed it? And more than once has Mrs. O'Callaghan assured me that the hothouses on her 'fawther's esteet' were three miles in length, and that each cluster of grapes grown on that favoured spot weighed above a hundredweight. With profound respect I gave ear to all she said; but, gentle daughter of Erin, did you think I was as soft as I seemed? You may just as well tell the truth at once, ye big talkers, for everybody will know it at any rate.

It is a sad pity when parents, by a long course of big talking and silly pretension, bring up their children with ideas of their own importance which make them appear ridiculous, and which are rudely dissipated on their entering into life. The mother of poor Lollipop, when he went to Cambridge, told me that his genius was such that he was sure to be Senior Wrangler. And possibly he might have been, if he had not been plucked.

It is peculiarly irritating to be obliged to listen to a vapouring person pouring out a string of silly exaggerated stories, all tending to show how great the vapouring person is. Politeness forbids your saying you don't believe them. I have sometimes derived comfort under such an infliction from making a memorandum, mentally, and then, like Captain Cuttle, 'making a note' on the earliest opportunity. By taking this course, instead of being irritated by each successive stretch, you are rather gratified by the number and enormity of them. I hereby give notice to all ladies and gentlemen whose conscience tells them that they are accustomed to vapour, that it is not improbable that I have in my possession a written list of remarkable statements made by them. It is possible that they would look rather blue if they were permitted to see it.

Let me add, that it is not always vapouring to talk of one's self, even in terms which imply a compliment. It was not vapouring when Lord Tenterden, being Lord Chief Justice of England, standing by Canterbury Cathedral with his son by his side, pointed to a little barber's shop, and said to the boy, 'I never feel proud except when I remember that in that shop your grandfather shaved for a penny!' It was not vapouring when Burke wrote, 'I was not rocked, and swaddled, and danced into a legislator; *Nitor in adversum* is the motto for a man like me!' It was not vapouring when Milton wrote that he had in himself a conviction that 'by labour and intent study, which he took to be his portion in this life, he might leave to after ages something so written as that men should not willingly

let it die.' Nor was it vapouring, but a pleasing touch of nature, when the King of Siam begged our ambassador to assure Queen Victoria that a letter which he sent to her, in the English language, was composed and written entirely by himself. It is not vapouring, kindly reader, when upon your return home after two or three days' absence, your little son, aged four years, climbs upon your knee, and begs you to ask his mother if he has not been a very good boy when you were away; nor when he shows you, with great pride, the medal which he has won a few years later. It is not vapouring when the gallant man who heroically jeopardized life and limb for the women's and children's sake at Lucknow, wears the Victoria Cross over his brave heart. Nor is it a piece of national vapouring, though it is, sure enough, an appeal to proud remembrances, when England preserves religiously the stout old *Victory*, and points strangers to the spot where Nelson fell and died.

MENSURATION.

To find the hypotenuse of a right-angled triangle.

- (1) If the base of a right-angled triangle be 45 ft. and the perpendicular 28 ft. what is the hypotenuse?
- (2) What is the hypotenuse when the base is 91 ft. and the perpendicular 60 ft?
- (3) The base of a triangle is 86 ft. and its perpendicular 90 ft.; what is its hypotenuse?
- (4) What must be the length of a ladder to reach a window 14 ft. from the ground, the bottom of the ladder being placed 10 ft. from the house?
- (5) The rafters in the roof of a certain house form a right angle at top, and they are 24 and 34 ft. in length respectively, the side-walls of the house being of the same height; what is the width of the house?

ROCK-SALT, COAL, AND SULPHUR.

(From 'Physical Geography,' by Sir John Herschel.)

su-per-fi'-cial-ly, as upon the surface
dis-tri-bu'-tion, the act of distributing or
spreading

ef-flor-es'-cence, the production of flowers,
or of bodies in a way similar to flowers

cal-car'-e-ous, chalky

gran-it'-ic, formed of granite

car-bon-if'-er-ous, producing coal

lat'-e-r-al, growing out of, or relating to
the side

dis-lo-ca-ted, displaced, put out of joint

met-a-mor'-phic, relating to a complete
change from one thing to another

suc'-cu-lent, juicy, having moisture

dis-til-la'-tion, the act of distilling

cry's-tal-li'-zed, formed of crystals

em-phat'-i-cal-ly, forcibly, especially,
particularly

ob-lit'-er-a-ted, effaced, destroyed

con-sol'-i-da-ted, hardened, combined

ROCK-SALT is commonly disposed in thick beds, either super-
ficially as in Africa, or at very great depths, as in the Polish

mines at Wieliczka; sometimes at great heights above the sea, as in the Cordilleras and in Savoy. The greatest deposit in England is near Northwich in Cheshire. In Spain, at Cordova, it forms a rugged precipice four or five hundred feet high, of such purity as to require only pounding to be fit for use. At Lahore in India a similiar mass occurs. In Afghanistan a road is cut out of solid salt at the foot of cliffs of that mineral 100 feet high. The island of Ormuz, at the entrance of the Persian Gulf, is a rock of salt. It is almost always found associated with gypsum.

Borax, a salt of great utility in the chemical arts, is one of rare and sparing distribution. The greater part in use is the product of a lake in Thibet, where, under the name of tincal, it is dug out in impure masses from the edges and shallows of the lake, being associated with common salt in the water. It occurs also in the province of Potosi in Peru. The boracic acid is found in hot springs near Sasso in Tuscany, and in Volcano, one of the Lipari Islands, in great purity. Soda, in the state of carbonate, occurs in abundance in the natron lakes of Egypt, and in four Hungarian lakes, and as an efflorescence on the surface of the earth in various arid and desert countries. Nitre is found encrusting chalk, limestone, or calcareous tufa, also in limestone caverns in North America, and in immense abundance as an efflorescence on the surface of the soil in several districts of India, as well as in Spain, Italy, and Hungary. The nitrate of soda, or 'cubic nitre,' as it is sometimes improperly called, forms a horizontal stratum many feet in thickness, and forty leagues in extent, in the district of Tarapaca in Peru, near the frontiers of Chili.

Porcelain Clay results from the decomposition of the felspar in granitic formations. Under the name of kaolin, it is quarried in China. It occurs also in great purity at Aue in Saxony, and at Meissen in Austria, near Passau, at Limoges, and near Bayonne in France. The porcelain manufactories of Worcester are supplied from St. Austel in Cornwall, at the foot of the granite range. In the granite districts of Ireland it also occurs abundantly.

COAL.—Happily for mankind this most useful mineral is very abundantly distributed over the world, though limited in its occurrence to those regions where the limestone of the (thence called) carboniferous series and their associated beds crop out to the surface or underlie other superficial beds at accessible depths. Coal is generally deposited in 'coal basins,' or great concave depressions of the strata, partly owing, no doubt, to the general curve of the ocean-beds in which the deposit was formed, but much more to their being broken up and dislocated by lateral upheavals, so that the parts no longer correspond—

a circumstance extremely favourable to their working, since the great inclination which the beds assume would otherwise carry them down beyond the reach of the miner, were it not that their broken edges are thus brought up again and made to outcrop on the surface.

The 'coal-measures,' or strata in which the beds of coal occur, usually alternating with clay and sandstone, are almost absolutely restricted to that group of the great geological series which used to be termed the transition series—that is to say, to the formations between the metamorphic rocks and the secondary limestones, &c., and more particularly to the upper Palæozoic formations between the Devonian and Permian groups, and in these, to the interval between the old red sandstone, the mountain or coral limestone and millstone grit below, and the new red sandstone and magnesian limestone above. From this circumstance (their coral substratum), from the nature of the fossils they enclose, and from the form and distribution of the carboniferous districts, it is inferred that their depositions took place in comparatively shallow seas, receiving the vegetable spoils of densely-clothed islands abounding in plants of a tropical character, and, in particular, with arborescent ferns, flags, reeds, and large trunks of succulent plants. Few animal remains, and scarcely a single shell or coral, are found in the coal-measures, while the vegetable forms, sometimes most beautifully preserved (though more ordinarily completely obliterated), which they contain, sufficiently prove their whole mass to consist of vegetable matter consolidated by heat (after undergoing a specific peatifying action by long submersion in water) under a pressure sufficient to retain the more volatile portions of their structure in combination with the carbon, forming bitumen and all the varieties of hydrocarbon, which, as is well known, the distillation of coal yields in abundance. Where the heat has been very violent, the coal is converted into anthracite or 'blind coal,' 'culm' or 'Welsh coal,' which is almost pure carbon; and in some instances, in the neighbourhood of trap-dykes, into true coke, evidently from the effect of heat under insufficient pressure.

The coal-measures would seem to mark an epoch of great interest in the geological history of the world, from the circumstance that whereas their strata bear every mark of great disturbance and violent dislocation, those incumbent on them are for the most part horizontal or comparatively little inclined. Such, at least, is the case in the great coal-series of England and the Netherlands, and such is the impression strongly left by the moderate inclination and slight disturbance of the sandstones immediately incumbent on the great coal-fields of North America.

Coal occurs in immense abundance in all those parts of England, Scotland, and Wales, where the strata above specified crop out, especially—(1.) In Northumberland and Durham, in a district the central point of which is somewhere about Jarrow, at the mouth of the Tyne, in which it has been calculated that between five and six thousand millions of tons of workable coal exist. (2.) In South Yorkshire, Nottingham, and Lancashire. (3.) In Staffordshire and Warwick, in a region having Ashby-de-la-Zouch for its centre. (4.) In what may be called the western and south-western coal districts, comprising Anglesey, Flintshire, Shropshire, South Gloucester, Somerset, Monmouth, and Glamorgan. (5.) The Scotch coal-field, occupying the great central lowland of Scotland. (6.) The Irish provinces of Leinster, Munster, and Connaught, and the counties of Tipperary and Tyrone. The larger portion of the whole area of Ireland, indeed, is occupied by the carboniferous formations.

On the continent of Europe, coal occurs in Belgium in the district about Liege; in France in the neighbourhood of Vienne on the Rhone. The south of Europe is, generally speaking, destitute of coal. It has hitherto been found but very sparingly in Russia. It has, however, been lately discovered, though of inferior quality, at a depth of 860 feet, near Moscow. By far the greatest system of coal-deposits known, however, is that of the United States of America. It is considered that the State of Pennsylvania consists, in about one-third of its area, of coal-fields belonging to the great Appalachian system of coal-measures, which extend altogether over upwards of 60,000 square miles. One of the seams in this formation, near Pittsburg, is worked through a large extent of its outcrop as an open quarry. The Illinois coal-field, which covers an area as large as England, in Illinois, Indiana, and Kentucky, consists of horizontal strata, and has numerous seams of excellent coal. Michigan, New Brunswick, Nova Scotia, and Vancouver's Island all yield coal in abundance. It occurs at the height of 14,750 feet in the Peruvian Andes. A great coal-field has been also ascertained to exist at St. Catherine's in Brazil, extending 140 leagues along the coast from Loguna in that province, almost to Monte Video, and 60 leagues inland from the Atlantic to St. Gabriel, and perhaps further.

Coal is also found in a vast number of other localities both in Asia and Australia, in Asia Minor (on the coast of the Black Sea, near Trebizond), in Borneo, Formosa, Tasmania, and New Zealand. In India, coal occurs on the Damoda river; also in Sylhet and Cashar.

Sulphur often accompanies salt and gypsum. It is produced in abundance, accompanying the latter mineral and sulphate of strontia (all three superbly crystallised), in the mines of

Catolica in Sicily. The greater part of the sulphur of commerce is procured from 'Solfataras', or volcanic half-extinguished vents, where from 'Fumaroles' and fissures in the soil the sulphur is sublimed. The Solfatara, emphatically so called, near Naples, supplies an immense quantity. There exist also great masses of sulphur, constituting almost mountains, such as the Sulphur Island of the Luchu Archipelago. Great quantities occur among the volcanoes of Iceland, of Java, and of the Andes. It is one of the most universal of volcanic products.

MENSURATION.

Exercises on triangles.

- (1) A ladder 50 ft. in length reaches a window on one side of a street 38 ft. from the pavement, and without moving the foot of the ladder it will reach a window on the other side of the street 44 ft. from the pavement; what is the width of the street?
- (2) There is a field in the form of a right-angled triangle, the shorter sides of which are 10.35 chains and 6.74 chains respectively; what is the length of the third side in yards?
- (3) A kite is flying attached to a string 212 yards in length. The distance of the person holding the string from another who stands immediately below the kite is 87 yards; allowing 20 yards for the curvature of the string, at what height is the kite from the ground?

THE SUPERIOR IMPORTANCE OF THE STUDY OF ENGLISH HISTORY.

(From the 'History of Civilisation in England,' by Mr. Buckle.)

is-so-late, to separate, to detach
in-vid'i-ous, likely to excite envy
qui-es-cent, being in a state of rest
con-ces-sion, the act of yielding
in-di-ge-nous, native to a country
met-a-phy-si-cian, one versed in the
science of the mind
dif-fu-sion, a spreading, dispersion
stim'u-lus (Lat.), an exciting cause
a-men'i-ty, agreeableness, pleasantness

in'-stil-gate, to urge, to provoke
im'-pe-tus, strong tendency to any point
di-ver-gence, tendency to various parts
from one point
in-ver-sion, a change of order
ju-ris-pru'-dence, the science of law
ac-cu-mu-la'-tion, a heaping up, an
increasing
con-tro-vert', to dispute, to contend
against

It is evident that, inasmuch as the great advantage of studying past events consists in the possibility of ascertaining the laws by which they were governed, the history of any people will become more valuable in proportion as their movements have been least disturbed by agencies not arising from themselves. Every foreign or external influence which is brought to bear upon a nation is an interference with its natural development, and therefore complicates the circumstances we

seek to investigate. To simplify complications is, in all branches of knowledge, the first essential of success. This is very familiar to the cultivators of physical science, who are often able, by a single experiment, to discover a truth which innumerable observations had vainly searched; the reason being, that by experimenting on phenomena, we can disentangle them from their complications; and thus isolating them from the interference of unknown agencies, we leave them, as it were, to run their own course, and disclose the operation of their own law.

This, then, is the true standard by which we must measure the value of the history of any nation. The importance of the history of a country depends not upon the splendour of its exploits, but upon the degree to which its actions are due to causes springing out of itself. If, therefore, we could find some civilised people who had worked out their civilisation entirely by themselves,—who had escaped all foreign influence, and who had been neither benefited nor retarded by the personal peculiarities of their rulers,—the history of such a people would be of paramount importance; because it would present a condition of normal and inherent development; it would show the laws of progress acting in a state of isolation; it would be, in fact, an experiment ready-made, and would possess all the value of that artificial contrivance to which natural science is so much indebted. To find such a people as this is obviously impossible; but the duty of the philosophic historian is, to select for his especial study the country in which the conditions have been most closely followed. Now, it will be readily admitted, not only by ourselves but by intelligent foreigners, that in England, during, at all events, the last three centuries, this has been done more constantly and more successfully than in any other country. I say nothing of the number of our discoveries, the brilliancy of our literature, or the success of our arms. These are invidious topics; and other nations may perhaps deny to us those superior merits which we are apt to exaggerate. But I take up this single position, that of all European countries, England is the one where, during the longest period, the government has been most quiescent, and the people most active; where popular freedom has been settled on the widest basis; where each man is most able to say what he thinks, and do what he likes; where everyone can follow his own bent, and propagate his own opinions; where, religious persecution being little known, the play and flow of the human mind may be clearly seen, unchecked by those restraints to which it is elsewhere subjected; where the profession of heresy is least dangerous, and the practice of dissent most common; where hostile creeds flourish side by side,

and rise and decay without disturbance, according to the wants of the people, unaffected by the wishes of the Church, and uncontrolled by the authority of the State; where all interests, and all classes, both spiritual and temporal, are most left to take care of themselves; where that meddling doctrine called Protection was first attacked, and where alone it has been destroyed; and where, in a word, those dangerous extremes to which interference gives rise, having been avoided, despotism and rebellion are equally rare, and concession being recognised as the groundwork of policy, the national progress has been least disturbed by the power of privileged classes, by the influence of particular sects, or by the violence of arbitrary rulers. That these are the characteristics of English history is notorious; to some men a matter of boast, to others of regret. And when to these circumstances we add, that England, owing to its insular formation, was, until the middle of the last century, rarely visited by foreigners, it becomes evident that, in our progress as a people, we have been less affected than any other by the two main sources of interference—namely, the authority of government, and the influence of foreigners. In the sixteenth century it became a fashion, among the English nobility, to travel abroad; but it was by no means the fashion for foreign nobility to travel in England. In the seventeenth century, the custom of travelling for amusement spread so much, that, among the rich and idle classes, there were few Englishmen who did not, at least once in their life, cross the Channel; while the same classes in other countries, partly because they were less wealthy, partly from an inveterate dislike to the sea, hardly ever entered our island, unless compelled to do so on some particular business. The result was, that in other countries, and particularly in France and Italy, the inhabitants of the great cities became gradually accustomed to foreigners, and, like all men, were imperceptibly influenced by what they often saw. On the other hand, there were many of our cities in which none but Englishmen ever set their feet; and inhabitants even of the metropolis might grow old without having once seen a single foreigner, except, perhaps, some dull and pompous ambassador, taking his airing on the banks of the Thames. And although it is often said that, after the restoration of Charles II., our national character began to be greatly influenced by French example, this, as I shall fully prove, was confined to that small and insignificant part of society which hung about the court; nor did it produce any marked effect upon the two most important classes—the intellectual class and the industrious class. The movement may, indeed, be traced in the most worthless parts of our literature—in the shameless productions of Buckingham, Dorset, Etherege, Kil

grew, Mulgrave, Rochester, and Sedley. But neither then, nor at a much later period, were any of our great thinkers influenced by the intellect of France; on the contrary, we find in their ideas, and even in their style, a certain rough and native vigour, which, though offensive to our more polished neighbours, has at least the merit of being the indigenous product of our own country. The origin and extent of that connection between the French and English intellects which subsequently arose, is a subject of immense importance; but like most others of real value, it has been entirely neglected by historians. In the present work I shall attempt to supply this deficiency; in the meantime I may say, that although we have been, and still are, greatly indebted to the French for our improvement in taste, in refinement, in manners, and indeed in all the amenities of life, we have borrowed from them nothing absolutely essential—nothing by which the destinies of nations are permanently altered. On the other hand, the French have not only borrowed from us some very valuable political institutions, but even the most important event in French history is due in no small degree to our influence. Their revolution of 1789 was, as is well known, brought about, or, to speak more properly, was mainly instigated, by a few great men, whose works, and afterwards whose speeches, roused the people to resistance; but what is less known, and nevertheless is certainly true, is, that these eminent leaders learnt in England that philosophy and those principles by which, when transplanted into their own country, such fearful and yet such salutary results were effected. It will not, I hope, be supposed that by these remarks I mean to cast any reflection on the French—a great and admirable people; a people in many respects superior to ourselves; a people from whom we have still much to learn, and whose deficiencies, such as they are, arise from the perpetual interference of a long line of arbitrary rulers. But, looking at this matter historically, it is unquestionably true that we have worked out our civilisation with little aid from them, while they have worked out theirs with great aid from us. At the same time, it must also be admitted, that our governments have interfered less with us than their governments have interfered with them. And without in the least prejudging the question as to which is the greater country, it is solely on these grounds that I consider our history more important than theirs; and I select for especial study the progress of English civilisation, simply because, being less affected by agencies not arising from itself, we can the more clearly discern in it the normal march of society, and the undisturbed operation of those great laws by which the fortunes of mankind are ultimately regulated.

After this comparison between the relative value of French and English history, it seems scarcely necessary to examine the claims which may be put forward for the history of other countries. Indeed, there are only two in whose favour anything can be said: I mean Germany, considered as a whole, and the United States of North America. As to the Germans, it is undoubtedly true that since the middle of the eighteenth century they have produced a greater number of profound thinkers than any other country—I might perhaps say, than all other countries put together. But the objections which apply to the French are still more applicable to the Germans; for the protective principle has been, and still is, stronger in Germany than in France. Even the best of the German governments are constantly interfering with the people; never leaving them to themselves, always looking after their interests, and meddling in the commonest affairs of daily life. Besides this, the German literature, though now the first in Europe, owes its origin, as we shall hereafter see, to that great sceptical movement by which, in France, the Revolution was preceded. Before the middle of the eighteenth century, the Germans, notwithstanding a few eminent names, such as Kepler and Leibnitz, had no literature of real value; and the first impetus which they received, was caused by their contact with the French intellect, and by the influence of those eminent Frenchmen who, in the reign of Frederick the Great, flocked to Berlin, a city which has ever since been the headquarters of philosophy and science. From this there have resulted some very important circumstances, which I can here only briefly indicate. The German intellect, stimulated by the French into a sudden growth, has been irregularly developed, and thus hurried into an activity greater than the average civilisation of the country requires. The consequence is, that there is no nation in Europe in which we find so wide an interval between the highest minds and the lowest minds. The German philosophers possess a learning, and a reach of thought, which places them at the head of the civilised world. The German people are more superstitious, more prejudiced, and, notwithstanding the care which the government takes of their education, more really ignorant, and more unfit to guide themselves, than are the inhabitants either of France or of England. This separation and divergence of the two classes is the natural result of that artificial stimulus, which a century ago was administered to one of the classes, and which thus disturbed the normal proportions of society. Owing to this, the highest intellects have, in Germany, so outstripped the general progress of the nation, that there is no sympathy between the two parties; nor are there at present any means by which they

may be brought into contact. Their great authors address themselves, not to their country, but to each other. They are sure of a select and learned audience, and they use what, in reality, is a learned language: they turn their mother-tongue into a dialect, eloquent indeed, and very powerful, but so difficult, so subtle, and so full of complicated inversions, that to their own lower classes it is utterly incomprehensible. From this there have arisen some of the most marked peculiarities of German literature. For, being deprived of ordinary readers, it is cut off from the influence of ordinary prejudice; and hence it has displayed a boldness of inquiry, a recklessness in the pursuit of truth, and a disregard of traditional opinions. But, on the other hand, this same circumstance has produced that absence of practical knowledge, and that indifference to material and physical interests, for which the German literature is justly censured. As a matter of course, all this has widened the original breach, and increased the distance which separates the great German thinkers from that dull and plodding class which, though it lies immediately beneath them, still remains uninfluenced by their knowledge, and uncheered by the glow and fire of their genius.

In America, on the other hand, we see a civilisation precisely the reverse of this. We see a country, of which it has been truly said, that in no other are there so few men of great learning, and so few men of great ignorance. In Germany, the speculative classes and the practical classes are altogether disunited; in America, they are altogether fused. In Germany, nearly every year brings forward new discoveries, new philosophies, new means by which the boundaries of knowledge are to be enlarged; in America, such inquiries are almost entirely neglected. Since the time of Jonathan Edwards no great metaphysician has appeared; little attention has been paid to physical science; and with the single exception of jurisprudence, scarcely anything has been done for those vast subjects on which the Germans are incessantly labouring. The stock of American knowledge is small, but it is spread through all classes; the stock of German knowledge is immense, but it is confined to one class. Which of these two forms of civilisation is the more advantageous, is a question we are not now called upon to decide. It is enough for our present purpose, that in Germany there is a serious failure in the diffusion of knowledge; and in America, a no less serious one in its accumulation. And as civilisation is regulated by the accumulation and diffusion of knowledge, it is evident that no country can even approach to a complete and perfect pattern, if, cultivating one of these conditions to an excess, it neglects the cultivation of the other. Indeed, from this want of balance

and equilibrium between the two elements of civilisation, there have arisen in America and in Germany those great but opposite evils, which, it is to be feared, will not be easily remedied; and which, until remedied, will certainly retard the progress of both countries, notwithstanding the temporary advantages which such one-sided energy does for the moment always procure.

I have very briefly, but I hope fairly, and certainly with no conscious partiality, endeavoured to estimate the relative value of the history of the four leading countries of the world. As to the real greatness of the countries themselves, I offer no opinion; because each considers itself to be the first. But, unless the facts I have stated can be controverted, it certainly follows that the history of England is, to the philosopher, more valuable than any other; because he can more clearly see in it the accumulation and diffusion of knowledge going hand in hand; because that knowledge has been less influenced by foreign and external agencies; and because it has been less interfered with, either for good or for evil, by those powerful but frequently incompetent men to whom the administration of public affairs is entrusted.

MENSURATION.

To find the area of any triangle when the three sides only are given.

- (1) Find the area of a triangle whose sides are 15, 13, and 14 yards respectively.
- (2) What is the area of a triangular field whose sides are 20, 30, and 40 chains respectively?
- (3) The side of an equilateral triangle is 36 ft., what is its area?
- (4) How many square yards are there in a right-angled triangle whose hypotenuse is 50, and one of its other sides 30 ft.?
- (5) What would be the cost of paving a triangular yard, its sides being 31 ft. 8 in., 35 ft., and 63 ft. 9 in. respectively, at 10d. per square foot?

THE THERMOMETER, ETC.

(From the 'Laboratory of Chemical Wonders,' by G. W. Septimus Piesse.)

fe'-tid, having a strong and offensive
smell
pu'-trous, growing rotten
in-fec'-tious, communicating disease
gel'-a-tine (n.), a substance like jelly
as-trin'-gen-ey, the power of binding
vir'-u-lence, poisonoumess, bitterness

ef'-flu'-vi-um, pl. ef'-flu'-vi-a (Lat.), a
minute particle flying off from a body
causing an offensive odour
in-fu'-sion, the liquor made by infusing
or steeping a body in a liquid
al-bu'-men, whites of egg

THE conditions in which we see water—at one time a crystal rock, in the shape of an iceberg, then as a purling stream, and again as a fleecy cloud, are so many eye lectures on the effects of heat. Solids become fluids, and liquids become gaseous, by the addition of heat. Reversing this operation—by cooling gaseous bodies they are converted into liquids, and fluids become solids. In the Arctic Circle, water, as such, is not known; it is always ice; but in India it rapidly takes the gas form, and disappears from the earth's surface. Whenever heat is added to any substance, the particles or atoms of which that body is composed seem to take a dislike to each other; they appear, as it were, to stand aloof, and try their utmost to get away. For this reason any substance, when heated, immediately swells—it expands. If a kettle be quite full when put on 'for tea,' long before the water boils a portion of it runs over; it has expanded so much that the kettle cannot hold it. If water be placed in a glass tube, under the influence of heat, then the effects of heat will be visible by its rising up the pipe. It is just upon this principle that thermometers are constructed. *Thermon*, heat; *metron*, a measure. A thermometer is therefore a heat-measurer, and indicates the relative quantity of heat by the relative expansion and contraction of the materials put into the tube. About the time of the memorable Prince of Orange, there lived in Holland a philosopher named Fahrenheit; it was he who first made a heat-measure. His name is stamped upon nearly all the thermometers made in England. Their form is well known; a glass pipe, with a globe at one end, filled either with quicksilver (mercury) or with spirit. These liquids are chosen in preference to all others, because their bulk is increased or diminished with less alteration of temperature than any other liquid would be. In the best, the bore of the pipe is so small that a hair would not pass through it. The least change of temperature, from warmth or cold, causes the mercury to expand or contract, and hence it rises or falls in the tube. One thing is important to remember—namely, that the same quantity of heat always causes the same degree of expansion. Fahrenheit found this out when he placed his heat

measure in boiling water; the mercury swelled, and rose up the tube to a certain height, and then remained stationary. It matters not how fast the water boils, it never gets any hotter. This point is indicated in a thermometer by the announcement that 'water boils.' Fahrenheit, in continuing his experiments, made a mixture of salt and powdered ice. On placing his thermometer in this mixture, the mercury sunk lower in it than anything else he had ever tried. When it had gone down to a given point it again remained stationary; and thinking he had discovered the greatest degree of cold, he called it Zero. Between Zero, or 0, and boiling water, he divided the thermometer into 212 parts, which he named degrees. When the measure was placed in clean ice, just as it began to melt, the mercury rose to 32° on his scale: this point was marked 'freezing,' because at any degree below 32° water becomes ice. The different marks upon a thermometer, such as 'summer heat,' 'spirit boils,' &c. merely indicate the relative expansion of the quicksilver at which these effects take place. The effects of heat are the same at all times and under all circumstances, though they are not perceived without a measure or thermometer. We know not how time flies without a clock.

DEODORISERS AND DISINFECTANTS.

The sense of smell is calculated to give warning of the vicinity of unwholesome objects. The influence of this faculty over the frame is very remarkable; one odour will instantly produce loathing, nausea, and vomiting; another, like the pleasant fragrance of the country air on a spring morning, has a part in producing an exhilarating influence upon the mind. It may be received as a standard rule, that when the air has an unpleasant odour it is unfit to breathe. Whenever such an effect is observed, the cause of the evil should at once be discovered, and the proper remedy applied: it is here where a little judgment is required. If the noxious matter exists in the air, and arises from being in the neighbourhood of a glue-maker, fat-melter, or other offensive works; or from the fetid breath of an invalid, or effluvia arising from putrescent wounds, then the remedy to apply must be one that will mix with and disseminate itself in the air, where meeting with the offensive material it will destroy its peculiar qualities. Of this class of substances the most effectual is chlorine gas, and the next best is strong acetic acid. Chlorine gas is easily made, thus:—Black oxide of manganese, one part, say one ounce; common salt, three parts, say three ounces; which mix, then add oil of *vitriol*, two or three teaspoonfuls; stir with a stick in a *gallipot*; place in room or stair, in hall or yard, close to the back

door, so that the fumes may pervade the whole house, three times a day.

A more simple, although more expensive process, is two ounces of strong hydrochloric acid, two ounces of water, and two drachms of chlorate of potass. Half the quantity will suffice in some cases.

Both these processes, although recommended by a good authority, generate the chlorine gas too fast.

For practical purposes the best plan is to mix equal parts of nitric and muriatic acids, and then gradually to add about a quarter of their weight of sulphuric acid. This mixture evolves the chlorine so slowly and regularly that it may be placed in a sick chamber.

We must not forget also that simple chloride of lime slowly gives out chlorine.

Concentrated acetic acid is also a powerful disinfectant. It is best used by being poured into a plate, and left to evaporate by the ordinary heat of the room it is required for; and if desired to be disseminated more rapidly, a little of the acid may be put into a red-hot iron spoon, and wafted about the apartment. Acetic acid is concentrated vinegar ten times the strength of table vinegar.

Both chlorine and acetic acid are termed disinfectants, because they destroy the virulence of infectious matter in the atmosphere. Deodorisers are preparations which have the quality of arresting the decay and of combining with the emanations from solid substances that are rotting. The best deodorisers are the metallic salts; such as acetate of lead, chloride of zinc, or sulphate of iron, dissolved in water. The most economical is the sulphate of iron—the common green copperas of commerce—which can now be obtained, in almost any quantity, at 60s. per ton, or about one-third of a penny per pound. One pound, dissolved in two or three gallons of water, will immediately deodorise and render harmless the most offensive cess-pool or drain. The operation should, however, be repeated from time to time. Its use in the sick room as a deodoriser would be a source of comfort both to patient and nurse.

HOW MUCH LEATHER DO WE EAT IN A YEAR?

None! a great many people will say. But they are mistaken; for, as an average, it may be stated, that each person during this period swallows *enough to make a pair of lady's shoes*. How is this? Well, I dare say it appears rather a riddle at first reading, but it is no more so than any other 'fact' which can clearly be demonstrated; here is the solution:—

Leather is made by steeping skins in an infusion of certain vegetable materials, which contain a substance called *tannin*.

(so named from the manufacture to which it is applied). This tanning principle, or matter, exists more or less in all plants, but the cheapest source for it is oak bark. We find it in the grape, in hops, in coffee, in tea, &c. It is well known that the 'virtue' of these substances is abstracted by water; or, in other words, the water dissolves out the tannin and other substances, which it is their nature to contain. The animal skin consists of albumen and gelatine; in fact, these two substances form the principal part of all animal matter. The blood is nearly all albumen and gelatine, or substances of the same composition and properties; so are eggs, and so is milk. In blood, in eggs, and in milk, the albumen is merely suspended, as it were, in water, and is identical with that found in flesh and skins. Tannin and albumen have a very extraordinary attraction or affinity for each other, so that when brought into contact they instantly unite; the result of this union is an insoluble, inodorous, tough material, which is known as leather (but which chemists call tannate of albumen). When, therefore, a skin (albumen) is steeped in a solution of oak-bark (tannin), these two matters unite, and leather is the result.

Again: when on our breakfast-table we have a cup of tea or coffee, and add to it a portion of milk, the tannin of the tea or coffee and this albumen of the milk unite instantly, and leather is produced, which, though certainly divided into minute flakes, requiring a microscope to make them visible, is nevertheless exactly the same material as manufactured by the tanner.

Tannin has a peculiar, what is called a 'rough' taste, and when taken into the stomach is highly astringent. We can detect its flavour while chewing the skin of a grape, or the stones in a raisin, in drinking port wine, and in coffee or tea before the milk is added; hence the application of this fluid. The real flavour of tea or coffee is masked by the tannin, unless milk, cream, or egg is added to combine with it. Now, presuming that each person takes three small cups of tea, *with milk*, twice a day, and allowing only one grain of leather to be formed in each cup, then it will be found that in the year each will have 'swallowed enough to make a pair of lady's shoes.'

The milk, uniting with the tannin of tea and coffee, modifies, in a beneficial point of view, their great astringency, and helps to destroy the effect they are said to have 'on the nerves' of those persons who take them without milk.

The action of milk on tea becomes very apparent when exhibited in a glass and held up to the light. Pour out the tea, and add drop by drop the milk, stirring now and then. It will be observed that a much greater opacity is produced by the *addition of milk to tea or coffee* than to a corresponding quantity of water which has been coloured with burnt sugar to the

same shade as the tea. The reason is obvious; the minute flakes of leather intercept the light. By using extra strong tea and pure milk, a precipitate or deposit of the tannate of albumen will take place in the course of an hour or so.

MENSURATION.

To find the area of an equilateral triangle.

- (1) There is a paddock in the form of an equilateral triangle whose side is 22 yards; what is its area?
- (2) What would be the rent of a triangular field each of whose sides measures 70 perches, at £1 10s. per acre?
- (3) What is the area of a triangular field whose sides are equal and whose perimeter is 75 chains?
- (4) What will be the side of a square equal in area to an equilateral triangle whose side is 30 ft.?
- (5) Calculate to 4 places of decimals the length of the side of an equilateral triangle equal in area to a parallelogram whose length is 28 ft. and breadth 25 ft.?

SELECTIONS FROM THE POEMS OF COWPER
AND CRABBE.

THE SOFA.

(William Cowper.)

[Born, 1731; died, 1800. Works: Letters and Poems. The latter are, 'The Task,' 'Conversation,' 'Table Talk,' 'The Progress of Error,' 'Translations from Homer,' &c. &c.]

sumpt'-u-ous, *splendid, expensive*
per'-ior-a-ted, *drilled or pierced with*
holes
vo-ra'-cious, *greedy to eat*
ver-mic'-u-lar, *like a worm*
me-di-oc'-ri-ty, *a middle, not superior*
state
ob'-du-rate, *inflexible, hard-hearted*

re-ce'-ding, *drawing back*
de-vi'-sed, *contrived*
re-lax'-a'-tion, *a slackening*
re-cum'-ben-cy, *a lying down*
bane (n.), *mischievous, ruin*
re-luc'-tance, *unwillingness*
loath (adj.), *unwilling*
gauge (v.), *to measure*

TIME was, when clothing sumptuous or for use,
Save their own painted skins, our sires had none.
As yet black breeches were not; satin smooth,
Or velvet soft, or plush with shaggy pile:
The hardy chief upon the rugged rock,
Wash'd by the sea, or on the gravelly bank,
Thrown up by wintry torrents roaring loud,
Fearless of wrong, reposed his weary strength.
Those barbarous ages past, succeeded next
The birthday of invention; weak at first,
Dull in design, and clumsy to perform.
Joint-stools were then created; on three legs

Upborne they stood. Three legs upholding firm
A massy slab, in fashion square or round.
On such a stool immortal Alfred sat,
And sway'd the sceptre of his infant realms :
And such in ancient halls and mansions drear
May still be seen ; but perforated sore,
And drill'd in holes, the solid oak is found,
By worms voracious, eating through and through.

At length a generation more refined
Improved the simple plan, made three legs four,
Gave them a twisted form vermicular,
And o'er the seat, with plenteous wadding stuff'd,
Induced a splendid cover, green and blue,
Yellow and red, of tap'stry rich wrought
And woven close, or needlework sublime.
There might ye see the piony spread wide,
The full-blown rose, the shepherd and his lass,
Lap-dog and lambkin with black staring eyes,
And parrots with twin cherries in their beaks.

Now came the cane from India, smooth and bright
With Nature's varnish, sever'd into stripes
That interlaced each other, these supplied
Of texture firm a lattice-work, that braced
The new machine, and it became a chair.
But restless was the chair ; the back erect
Distress'd the weary loins, that felt no ease
The slippery seat betray'd the sliding part
That press'd it, and the feet hung dangling down,
Anxious in vain to find the distant floor.
These for the rich ; the rest, whom Fate had placed
In modest mediocrity, content
With base material, sat on well-tann'd hides,
Obdurate and unyielding, glassy smooth,
With here and there a tuft of crimson yarn,
Or scarlet crevel, in the cushion fix'd,
If cushion might be call'd, what harder seem'd
Than the firm oak, of which the frame was form'd.
No want of timber then was felt or fear'd
In Albion's happy isle. The lumber stood
Ponderous and fix'd by its own massy weight.
But elbows still were wanting ; these, some say,
An alderman of Cripplegate contrived ;
And some ascribe the invention to a priest,
Burly and big, and studious of his ease.
But, rude at first, and not with easy slope
Receding wide, they pressed against the ribs,
And bruised the side ; and, elevated high,

Taught the raised shoulders to invade the ears.
 Long time elapsed or ere our rugged sires
 Complained, though incommodiously pent in,
 And ill at ease behind. The ladies first
 'Gan murmur as became the softer sex.
 Ingenious fancy, never better pleased
 Than when employ'd to accommodate the fair,
 Heard the sweet moan with pity, and devised
 The soft settee ; one elbow at each end,
 And in the midst an elbow it received,
 United yet divided, twain at once.
 So sit two kings of Brentford on one throne ;
 And so two citizens, who take the air,
 Close pack'd, and smiling, in a chaise and one.
 But relaxation of the languid frame,
 By soft recumbency of outstretch'd limbs,
 Was bliss reserv'd for happier days. So slow
 The growth of what is excellent ; so hard
 To attain perfection in this nether world.
 Thus first necessity invented stools,
 Convenience next suggested elbow-chairs,
 And luxury the accomplish'd Sofa last.

The Task.

 ISAAC ASHFORD.

(*Rev. G. Crabbe.*)

[Born, 1754 ; died, 1832. Poems : 'The Village,' 'Parish Register,' 'The Parsonage,' 'Tales in Verse,' 'Tales of the Hall.']

Next to these ladies, but in nought allied,
 A noble peasant, Isaac Ashford, died.
 Noble he was, contemning all things mean,
 His truth unquestioned, and his soul serene :
 At no man's presence Isaac felt afraid ;
 At no man's question Isaac looked dismayed :
 Shame knew him not, he dreaded no disgrace ;
 Truth, simple truth, was written in his face ;
 Yet while the serious thought his soul approved,
 Cheerful he seemed, and gentleness he loved ;
 To bliss domestic he his heart resigned,
 And with the firmest, had the fondest mind :
 Were others joyful, he looked smiling on,
 And gave allowance where he needed none ;
 Good he refused with future ill to buy,
 Nor knew a joy that caused reflection's sigh ;

A friend to virtue, his unclouded breast
No envy stung, no jealousy distressed
(Bane of the poor, it wounds their weaker mind
To miss one favour which their neighbours find);
Yet far was he from stoic pride removed;
He felt humanely, and he warmly loved:
I marked his action when his infant died,
And his old neighbour for offence was tried;
The still tears stealing down that furrowed cheek,
Spoke pity plainer than the tongue can speak.
If pride were his 'twas not their vulgar pride,
Who, in their base contempt, the great deride;
Nor pride in learning, though my clerk agreed,
If fate should call him, Ashford might succeed;
Nor pride in rustic skill, although we knew
None his superior, and his equals few:
But if that spirit in his soul had place,
It was the jealous pride that shuns disgrace;
A pride in honest fame, by virtue gained,
In sturdy boys to virtuous labours trained;
Pride in the power that guards his country's coast,
And all that Englishmen enjoy and boast;
Pride in a life that slander's tongue defied,
In fact, a noble passion, misnamed pride. . . .
At length he found when seventy years were run,
His strength departed and his labour done;
When, save his honest fame, he kept no more;
But lost his wife and saw his children poor;
'Twas then a spark of—say not discontent—
Struck on his mind, and thus he gave it vent:
'Kind are your laws ('tis not to be denied),
That in yon house for ruined age provide,
And they are just; when young, we give you all,
And then for comforts in our weakness call.
Why then this proud reluctance to be fed,
To join your poor, and eat the parish bread?
But yet I linger, loath with him to feed
Who gains his plenty by the sons of need:
He who, by contract, all your paupers took,
And gauges stomachs with an anxious look:
On some old master I could well depend;
See him with joy, and thank him as a friend;
But ill on him who doles the day's supply,
And counts our chances who at night may die:
Yet help me, Heaven! and let me not complain
Of what befalls me, but the fate sustain.'

Such were his thoughts, and so resigned he grew;

Daily he placed the workhouse in his view !
But came not there, for sudden was his fate,
He dropt, expiring at his cottage-gate.

I feel his absence in the hours of prayer,
And view his seat, and sigh for Isaac there ;
I see no more his white locks thinly spread
Round the bald polish of that honoured head ;
No more that awful glance on playful wight
Compelled to kneel and tremble at the sight ;
To fold his fingers all in dread the while,
Till Mister Ashford softened to a smile ;
No more that meek and suppliant look in prayer
Nor the pure faith (to give it force) are there. . . .
But he is blest, and I lament no more,
A wise good man, contented to be poor.

Parish Register.

MENSURATION.

To find the area of a trapezium :—

-) What is the area of the trapezium ABCD,* the diagonal AC being 120 yards, the perpendicular DE 30 yards, and BF 25 yards ?
-) What will be the area of a field in the form of a trapezium ABCD, when the perpendiculars are 3·5 and 4·75 chains respectively, and the diagonal 10 chains ?
-) Given, in the trapezium ABCD, AB 210 yards, DC 360 yards, BF 180 yards, DE 240 yards, and FE 210 yards ; find its area in acres, &c.

To find the area of a trapezoid :—

-) What is the area of the trapezoid ABCD,* the parallel sides being 4 ft. 6 in. and 8 ft. 6 in. respectively, and the perpendicular height AE 6 ft. ?
-) What is the area of a field in the form of a trapezoid whose sides are 12·6 and 10·75 chains respectively, and perpendicular height 8·25 chains ?

THE RUINS OF ASSYRIA.

(From 'Nineveh and its Remains,' by A. H. Layard.)

il-o-lo'-gi-cal, relating to language
i-phi-the'-a-tre, a building of a circular form, with seats all round
'nel-form, having the form of a wedge
ad'-ran-gle, a figure with four angles
i-pen'-dous, wonderful, astonishing

con-jec'-ture (v.), to guess
vague, unfixed, indefinite
con-sec'-u-tive, following in succession
e-jac-u-la'-tion, a short occasional prayer, a sudden exclamation

HAD traversed Asia Minor and Syria, visiting the ancient
sites of civilisation, and the spots which religion has made
holy. I now felt an irresistible desire to penetrate to the

* See definitions and figures at the end.

regions beyond the Euphrates, to which history and tradition point as the birthplace of the wisdom of the West. Most travellers, after a journey through the usually frequented parts of the East, have the same longing to cross the great river and to explore those lands which are separated on the map from the confines of Syria by a vast blank stretching from Aleppo to the banks of the Tigris. A deep mystery hangs over Assyria, Babylonia, and Chaldæa. With these names are linked great nations and great cities dimly shadowed forth in history; mighty ruins, in the midst of deserts, defying by their very desolation and lack of definite form, the description of the traveller; the remnants of mighty races still roving over the land; the fulfilling and fulfilment of prophecies; the plains to which the Jew and the Gentile alike look as the cradle of their race. After a journey in Syria the thoughts naturally turn eastward; and without treading on the remains of Nineveh and Babylon our pilgrimage is incomplete.

I left Aleppo with my companion on the 18th of March. We still travelled as we had been accustomed—without guide or servants. The road across the desert is at all times impracticable, except to a numerous and well-armed caravan, and offers no object of interest. We preferred that through Bir and Orfa. From the latter city we traversed the low country at the foot of the Kurdish hills, a country little known, and abounding in curious remains. The Egyptian frontier at that time extended to the east of Orfa, and the war between the Sultan and Mahommed Ali Pasha being still unfinished, the tribes took advantage of the confusion, and were plundering on all sides. With our usual good fortune, we succeeded in reaching Nisibin unmolested, although we ran daily risks, and more than once found ourselves in the midst of foraging parties, and of tents which an hour before had been pillaged by the wandering bands of Arabs. We entered Mosul on the 10th of April.

During a short stay in this town we visited the great ruins on the east bank of the river, which have been generally believed to be the remains of Nineveh. We also rode into the desert and explored the mound of Kalah Sherghat, a vast ruin on the Tigris about fifty miles below its junction with the Zab. As we journeyed thither we rested for the night at the small Arab village of Hammum Ali, around which are still the vestiges of an ancient city. From the summit of an artificial eminence we looked down upon a broad plain, separated from us by the river. A line of lofty mounds bounded it to the east, and one of a pyramidal form rose high above the rest. Beyond it could be faintly traced the waters of the Zab. Its position rendered its identification easy. This was the pyramid which *Xenophon* had described, and near which the ten thousand had

encamped: the ruins around it were those which the Greek general saw twenty-two centuries before, and which were even then the remains of an ancient city. Although Xenophon had confounded a name, spoken by a strange race, with one familiar to a Greek ear, and had called the place Larissa, tradition still points to the origin of the city, and, by attributing its foundation to Nimrod, whose name the ruins now bear, connects it with one of the first settlements of the human race.*

Kalah Sherghat, like Nimroud, was an Assyrian ruin: a vast shapeless mass, now covered with grass, and showing scarcely any traces of the work of man except where the winter rains had formed ravines down its almost perpendicular sides, and had thus laid open its contents. A few fragments of pottery and inscribed bricks, discovered after a careful search amongst the rubbish which had accumulated around the base of the great mound, served to prove that it owed its construction to the people who had founded the city of which Nimroud is the remains. There was a tradition current amongst the Arabs, that strange figures carved in black stone still existed among the ruins; but we searched for them in vain during the greater part of a day, in which we were engaged in exploring the heaps of earth and bricks covering a considerable extent of the country on the right bank of the Tigris. At the time of our visit the country had been abandoned by the Bedouins, and was only occasionally visited by a few plunderers from the Shammar or Aneyza tents. We passed the night in the jungle which clothes the banks of the river, and wandered during the day undisturbed by the tribes of the desert. A Cawass who had been sent with us by the Pasha of Mosul, alarmed at the solitude and dreading the hostile Arabs, left us in the wilderness and turned homewards. But he fell into the danger he sought to avoid. Less fortunate than ourselves, at a short distance from Kalah Sherghat he was met by a party of horsemen, and fell a victim to his timidity.

Were the traveller to cross the Euphrates to seek for such ruins in Mesopotamia and Chaldæa as he had left behind him in Asia Minor or Syria, his search would be vain. The graceful column rising above the thick foliage of the myrtle, ilex, and oleander; the gradines of the amphitheatre covering a gentle slope, and overlooking the dark blue waters of a lake-like bay;

* 'He (Nimrod) went out into Assyria and built Nineveh, the city Rehoboth and Calah, and Resen, between Nineveh and Calah; the same is a great city.' (Gen. x. 11, 12.) The ruins of Nimroud had been identified with Resen, of which Larissa was believed, first by Bochart, to be a corruption, arising from the (presumed) use by the inhabitants of the country of the common Shemitic article 'al' before the word. It may be observed, in the first place, that the philological grounds are inadequate: and, in the second, that if this were Resen, no room would be left for the site of Nineveh, a still greater city.

the richly carved cornice or capital half-hidden by the luxuriant herbage; are replaced by the stern shapeless mound rising from the scorched plain, the fragments of pottery, and the stupendous mass of brickwork occasionally laid bare by the winter rains. He has left the land where nature is still lovely—where, in his mind's eye, he can rebuild the temple or the theatre, half doubting whether they would have made a more grateful impression upon the senses than the ruin before him. He is now at a loss to give any form to the rude heaps upon which he is gazing. Those, of whose works they are the remains, unlike the Roman and the Greek, have left no visible traces of their civilisation or of their arts: their influence has long since passed away. The more he conjectures, the more vague the results appear. The scene around is worthy of the ruin he is contemplating; desolation meets desolation; a feeling of awe succeeds to wonder; for there is nothing to relieve the mind, or to tell of what has gone by. These huge mounds of Assyria made a deeper impression upon me, gave rise to more serious thoughts and more earnest reflection, than the temples of Balbec and the theatres of Iona.

In the middle of April I left Mosul for Baghdad. As I descended the Tigris on a raft, I again saw the ruins of Nimroud, and had a better opportunity of examining them. It was evening as we approached the spot. The spring rains had clothed the mound with the richest verdure, and the fertile meadows, which stretched around it, were covered with flowers of every hue. Amidst this luxuriant vegetation were partly concealed a few fragments of bricks, pottery, and alabaster, upon which might be traced the well-defined wedges of the cuneiform character. Did not these remains mark the nature of the ruin, it might have been confounded with a natural eminence. A long line of consecutive narrow mounds, still retaining the appearance of walls or ramparts, stretched from its base, and formed a vast quadrangle. The river flowed at some distance from them: its waters, swollen by the melting of the snows on the Armenian hills, were broken into a thousand foaming whirlpools by an artificial barrier, built across the stream. On the eastern bank the soil had been washed away by the current; but a solid mass of masonry still withstood its impetuosity. The Arab who guided my small raft gave himself up to religious ejaculations as we approached this formidable cataract, over which we were carried with some violence. Once safely through the danger, he explained to me that the unusual change in the quiet face of the river was caused by a great dam which had been built by Nimrod, and *that in the autumn, before the winter rains, the huge stones with which it was constructed, squared, and united by cramps*

of iron, were frequently visible above the surface of the stream. It was, in fact, one of those monuments of a great people, to be found in all the rivers in Mesopotamia, which were undertaken to ensure a constant supply of water to the innumerable canals, spreading like network over the surrounding country, and which, even in the days of Alexander, were looked upon as the works of an ancient nation. No wonder that the traditions of the present inhabitants of the land should assign them to one of the founders of the human race! The Arab explained the connection between the dam and the city, built by Athur, the lieutenant of Nimrod, the vast ruins of which were then before us, and of its purpose as a causeway for the mighty hunter to cross to the opposite palace, now represented by the mound of Hammum Ali. He was telling me of the histories and fate of the kings of a primitive race, still the favourite theme of the inhabitants of the plain of Shinar, when the last glow of twilight faded away, and I fell asleep as we glided onward to Bagdad.

MENSURATION.

From the diameter of a circle to find the circumference:—

- (1) What is the circumference of a circle whose diameter is 15 ft.?
- (2) The diameter of a circle is 20 ft.; what is its circumference?
- (3) The diameter of the earth is 7958 miles; what is its circumference?
- (4) The circumference of a circular grass-plot is 100 ft.; what is its diameter?
- (5) What will be the weight of iron in the felloe of a wheel 4 ft. in diameter, the iron of which the felloe is made weighing 6 lbs. per foot run?
- (6) The circumference of a circle is 760 ft.; find its diameter.

THE BATTLE OF THE BOYNE.

(From the 'Comprehensive History of England,' by C. Macfarlane and Rev. T. Thomson.)

pro-ro-ga'-tion, continuance; the continuance of Parliament from one Session to another
 tem'-po-ra-ry, lasting only for a time
 ap-prise', to inform, to give notice

re-con-vo'-tre (Fr.), to survey, to examine
 en ri-cochet' (Fr.), slantingly
 im'-mi-nent, threatening, near

[In consequence of the despotic conduct of James II., and his attempts to establish Popery, the leading men opened correspondence with William, Prince of Orange, husband of the Princess Mary, the daughter of James. William landed at Torbay, December 10th, 1688. James left England for France, December 23rd. The Houses of Parliament declared that, by this act, he had abdicated, and they elected William and Mary to the vacant throne, February 12th, 1689. Ireland still owned the authority of James, who, having interested Louis XIV. of France in his favour, collected an army and landed in that country. The result of the battle of the Boyne was the final blow to his hopes of re-establishing his power.]

TWELVE days after the prorogation, William left London for Ireland; and on the 14th of June he landed at Belfast with a force not very considerable in point of numbers, but perfect in discipline, appointment, spirit, and devotion to his cause. It included English, Scots, Dutch, Danes, and French; and, when it was joined to Schomberg's forces and the Protestant volunteers that flocked in from various parts of Ireland, it made up an army of 30,000 men. In the ten months that Schomberg had held the chief command, little had been done towards the reduction of that unhappy island. On his first landing he took Belfast, Carrickfergus, Newry, and Dundalk; but at the latter place he was brought to a stand by De Rosen, and about the middle of September, King James came up in person with the remainder of his army, and obliged the old marshal to intrench himself at and round about Dundalk. The Jacobites endeavoured to force him to a battle, but they failed in their attempts. On the 27th of September, Schomberg wrote to William, that the best thing he could do was to lie there on the defensive. On the other side, De Rosen would not venture an attack upon Schomberg's positions and intrenchments, and, as the bad weather set in, King James retired to Ardee and fortified himself there. Schomberg's forces lay, for the most part, out upon cold wet ground, and suffered severely. In the beginning of February, James's natural son, the Duke of Berwick, who had most of the qualities of a good soldier, made an attack upon the advanced position of Schomberg at Belurbet; but he was worsted and nearly killed in the action, having his horse shot under him. In the month of May, Charlemont, which had been bravely defended by Sir Teague O'Regan, was forced by famine to surrender to the Protestants. And by this time the English fleet scoured St. George's Channel, carried provisions to Schomberg's half-famished troops, and took the only man-of-war James had, out of the very roadside of Dublin, where it lay at anchor.

His absolute dependency upon France showed the hopelessness of James's cause, and prevented many from joining it that were otherwise well disposed towards him. Louis was, as we have seen, in the greatest difficulties himself, and to him the war in Ireland was, and could be, nothing but a temporary diversion. Yet he now sent over 6,000 men, some money, and some clothes for James's army. De Rosen having retired in despair or disgust, these French troops were entrusted to the Count de Lauzun, who, on his arrival in Ireland, assumed the chief command of the whole army. But Lauzun was incompetent and arrogant; he was constantly quarrelling with the *Irish*, and he found the French officers weary of the hard *service* in Ireland, and completely disheartened. Even in this

situation were James's affairs when he was apprised that William had landed, and would soon be upon him. After various consultations and conflicting opinions, he resolved to advance as far as Dundalk, to eat up the forage thereabout, and preserve his own country behind him; and in pursuance of this plan he left Dublin on the 16th of June. Upon that day King William was at Belfast, attended by Prince George of Denmark, the Duke of Ormond, the Earls of Oxford, Scarborough, and Manchester, Mr. Boyle, and many other persons of note, civilians as well as military, Irish as well as English. The preceding day, being Sunday, Dr. Rouse had preached before him on the text, 'Through faith they have subdued kingdoms,' upon which occasion William had said, 'My chaplain has begun the campaign bravely.' Two or three days after, he told his officers that he did not come there to let grass grow under his feet; and moving forward to Loughbrickland, he reviewed his whole army, and found it to consist of about 36,000 men, all in good order. From that point he marched towards Newry, and was so well pleased with the prospect of the country, that he said to those about him, 'It is worth fighting for.' In the meanwhile James had encamped behind the small river which runs into the sea at Dundalk, where he lay till June 23, when he fell back upon Ardee. William, making a compass, crossed the hills between Newry and Dundalk; and on his approach on the 27th, James retired from Ardee to Dumlane, and on the 28th, to the left bank of the river Boyne. On the 29th James crossed the Boyne and took up an excellent position on the right bank. On the 30th, William reached the Boyne, and found his enemies encamped along the river in two strong lines. He, however, resolved to force the passage on the morrow, and rode along the left bank to reconnoitre. While engaged in this service, the enemy brought two field-pieces to bear upon him, and at the first shot they killed a man and two horses that were very near him. This ball was presently followed by another, that had like to put a period to William's own life; for this second ball, having first grazed on the bank of the river, rising *en ricochet*, slanted on the king's right shoulder, took out a piece of his coat and tore the skin and flesh, and afterwards broke the head of a gentleman's pistol. Lord Coningsby rode up to his Majesty and clapped his handkerchief on the wound; but William said, coolly, that it needed not—that the ball should have come nearer to do him harm. But the enemy on the opposite side of the river, seeing that he stooped in his saddle, and that there was some disorder among those who attended him, joyfully concluded that he was killed, and this false report was conveyed with wonderful rapidity to Dublin, from Dublin to Paris, and

from Paris to every capital in Europe. The rapturous joy felt by his enemies, and the grief and despair of his friends, were alike tributes to the merits of William, or proofs of how much was considered to depend upon his person. In the meantime, having got his flesh-wound dressed, he continued on horseback nearly the whole of that day. About nine at night he called his officers together, and declared that he would pass the river on the morrow. That day of slaughter soon dawned: it was the 1st of July, and the weather was beautifully clear. The générale was beat in the camp before day, and as soon as the sun was up, Schomberg and General Douglas moved with the right wing towards Slane. The Irish, by a corresponding movement, brought their left wing to Slane, but the English dashed into the river and forded it there. The wretched James had already sent off his baggage and all his cannon but six towards Dublin; and his left wing, after a smart fight, retreated before the horse, foot, and artillery of Douglas, who, with little loss, got a firm footing on the right bank of the Boyne. Nearly at the same time William made an attack on the pass at Old Bridge, and the Dutch blue guards, beating a march till they got to the water's edge, went in eight or ten abreast, and waded across with the water above their girdles. When they got into the middle of the stream they were saluted with a terrible peal by the Irish, who had lined the houses, hedges, and breast works on the other side; but the Dutchmen went on, got a footing on the bank, formed in two lines, and soon drove the Irish from their intrenchments. The blue guards then advancing into the open fields, were set upon furiously by the Irish horse; but they stood close and firm, and, as other regiments came up to their assistance, the Irish retired. At another point the Irish horse, who behaved very gallantly, drove a body of Danes and of French Protestants back into the river. Old Schomberg, perceiving this disorder, and that the French Protestants were left much exposed and without a commander, passed the river himself, in order to lead them. Pointing to the French Papists in James's ranks, he exclaimed to the Huguenots, 'Allons, messieurs, voilà vos persécuteurs;' but he had scarcely said the word when he was slain, being shot through the neck by a fleeing party of James's horseguards, or, 'through a fatal mistake,' by some of his own men. When James was already edging off to the Dublin road, William crossed the river, and drawing his sword, not without pain, his arm being stiff from the wound he had received the day before, he marched at the head of the Enniskilleners and Dutch guards rapidly towards the enemy's centre, which,

* 'Come on, gentlemen, these are your persecutors.'

though somewhat confused, was as yet unbroken. Once, if not twice, William was driven back and put in imminent danger by the Irish horse and the French troops of Lauzun; but the Enniskilleners performed most manfully, Schomberg's horse came up, General Ginckel made some brilliant charges; and, in the end, James's army was beaten, right, left, and centre, and pushed off the field. The fleeing James got to Dublin that night, but he no longer considered himself safe there, and, travelling all night, he got to Duncannon about sunrise, and there embarked for France. Attempts have been made to give a different colouring to his conduct; but a cool examination of facts enforces the impression that he really ended as a coward the enterprise which he had begun and conducted like a fool.

The poor Irish, smarting under defeat, and forgetting other considerations, said, with some humour, that if the English would only change kings with them, they would be glad to fight the battle of the Boyne over again. They and their French allies had lost about 1,500 men in the battle and retreat, and among them some persons of note, as Lord Dangan, the Earl of Carlingford, Fitzgerald, Sir Neal O'Neal, the Marquis d'Hoquincour, Colonel Casanova, &c. Driven from the Boyne, they resolved to make a stand on the Shannon, where the standard of James still floated over the strong walls of Athlone and Limerick. Drogheda, at the mouth of the Boyne, surrendered the day after the victory, and on July 3, the Duke of Ormond, with nine troops of horse, secured Dublin for King William, who, on the 4th, marched that way with his whole army, and on the 8th rode in a triumphant manner into that capital, where the Protestants, and for the same sort of reasons, were as joyful as the Papists had been the year before at the arrival of King James. He went directly to the cathedral church of St. Patrick, now again restored to the Protestant faith, and returned thanks for his victory.

MENSURATION.

To find the area of a circle:—

- (1) Find the area of a circle whose diameter is 40.
- (2) What is the area of a circle whose circumference is 9·2?
- (3) What is the area of a semicircle whose diameter is 200?
- (4) Find the area of a quadrant whose radius is 10 feet.
- (5) What must be the length of a cord fastened to a cow's horn at one end, and a stake at the other, to enable it to feed on two acres of land, and no more?
- (6) In running a surveying wheel round the edge of a circular pond, it turns 455 times. Now, the circumference of the wheel is 8 ft. 3 in. What is the area of the pond?

AURORA BOREALIS.

(From 'Cosmos,' by A. Von Humboldt.)

zen'-ith, the point of the heavens imme-
diately overhead
si-mul-ta'-ne-ous, existing or happening
at the same time
pre-mon'-i-to-ry, giving previous warn-
ing
e-qui-lib'-ri-um, equality of weight
e-ri'-us-ea'-tion, a sudden burst of light
eir'-ro cu'-mu-li, tufty, heaps of clouds

en-gen'-der, to produce, to cause
dy-nam'-ics, the science of force
em-pir'-i-cal, to know only by experience,
versed in experiments
ho'-ra-ry, relating to an hour
tel-lu'-ric, relating to the earth
max'-i-mum, the greatest or highest
number or quantity
em'-a-nate, to flow from

TERRESTRIAL magnetism, and the electro-dynamic forces com-
puted by the intellectual Ampère, stand in simultaneous and
intimate connection with the terrestrial or polar light, as well as
with the internal and external heat of our planet, whose magnetic
poles may be considered as the poles of cold. The bold conjecture
hazarded one hundred and twenty-eight years since by Halley,
that the aurora borealis was a magnetic phenomenon, has ac-
quired empirical certainty from Faraday's brilliant discovery of
the evolution of light by magnetic forces. The northern light is
preceded by premonitory signs. Thus in the morning before the
occurrence of the phenomenon, the irregular horary course of
the magnetic needle generally indicates a disturbance of the
equilibrium in the distribution of terrestrial magnetism. When
this disturbance attains a great degree of intensity, the equi-
librium of the distribution is restored by a discharge attended
by a development of light. 'The aurora itself is therefore not
to be regarded as an externally manifested cause of this dis-
turbance, but rather as a result of telluric activity, manifested
on the one side by the appearance of the light, and on the other
by the vibrations of the magnetic needle.' The splendid ap-
pearance of coloured polar light is the act of discharge, the
termination of a magnetic storm, as in an electrical storm, a
development of light—the flash of lightning—indicates the re-
storation of the disturbed equilibrium in the distribution of the
electricity. An electric storm is generally confined to a small
space, beyond the limits of which the condition of the atmo-
spheric electricity remains unchanged. A magnetic storm, on
the other hand, shows its influence on the course of the needle
over large portions of continents, and, as Arago first discovered,
far from the spot where the evolution of light was visible.
It is not improbable that as heavily-charged threatening clouds,
owing to frequent transitions of the atmospheric electricity to
an opposite condition, are not always discharged accompanied
by lightning; so likewise magnetic storms may occasion far ex-
tending disturbances in the horary course of the needle, with

out there being any positive necessity that the equilibrium of the distribution should be restored by explosion or by the passage of luminous effusions from one of the poles to the equator, or from pole to pole.

In collecting all the individual features of the phenomenon in one general picture, we must not omit to describe the origin and course of a perfectly developed aurora borealis. Low down in the distant horizon, about the part of the heavens which is intersected by the magnetic meridian, the sky which was previously clear is at once overcast. A dense wall or bank of cloud seems to rise gradually higher and higher till it attains an elevation of 8° or 10° . The colour of the dark segment passes into brown or violet; and stars are visible through the cloudy stratum, as when a dense smoke darkens the sky. A broad brightly luminous arch, first white, then yellow, encircles the dark segment; but as the brilliant arch appears subsequently to the smoky-grey segment, we cannot agree with Argelander in ascribing the latter to the effect of mere contrast with the bright luminous margin. The highest point of the arch of light is, according to accurate observations made on this subject, not generally in the magnetic meridian itself, but from 5° to 18° towards the direction of the magnetic declination of the place. In northern latitudes, in the immediate vicinity of the magnetic pole, the smoke-like conical segment appears less dark, and sometimes is not even seen. Where the horizontal force is the weakest, the middle of the luminous arch deviates the most from the magnetic meridian.

The luminous arch remains sometimes for hours together flashing and kindling in ever-varying undulations, before rays and streamers emanate from it, and shoot up to the zenith. The more intense the discharges of the northern light, the more bright is the play of colours, through all the varying gradations from violet and bluish white to green and crimson. Even in ordinary electricity excited by friction the sparks are only coloured in cases where the explosion is very violent after great tension. The magnetic columns of flame rise either singly from the luminous arch, blended with black rays similar to thick smoke, or simultaneously in many opposite points of the horizon, uniting together, form a flickering sea of flame, whose brilliant beauty admits of no adequate description, as the luminous waves are every moment assuming new and varying forms. The intensity of this light is at times so great, that Lowenörn (on June 29, 1786) recognised the coruscation of the polar light in bright sunshine. Motion renders the phenomenon more visible. Round the point in the vault of heaven which corresponds to the direction of the inclination of the needle, the beams unite together to form the so-called *corona*,

the crown of the northern light, which encircles the summit of the heavenly canopy with a milder radiance and unflickering emanations of light. It is only in rare instances that a perfect crown or circle is formed, but on its completion the phenomenon has invariably reached its maximum, and the radiations become less frequent, shorter, and more colourless. The crown and luminous arches break up, and the whole vault of heaven becomes covered with irregularly scattered, broad, faint, almost ashy-grey, luminous, immovable patches, which in their turn disappear, leaving nothing but a trace of the dark, smoke-like segment on the horizon. There often remains nothing of the whole spectacle but a white, delicate cloud with feathery edges, or divided at equal distances into small roundish groups like cirro-cumuli. This connection of the polar light with the most cirrous clouds deserves special attention, because it shows that the electro-magnetic evolution is a part of the meteorological process. Terrestrial magnetism here manifests its influence on the atmosphere and on the condensation of aqueous vapour. The fleecy clouds seen in Iceland by Thienemann, and which he considered to have been the northern lights, have been seen in recent lines by Franklin and Richardson near the American North Pole; and by Admiral Wrangel on the Siberian coast of the Polar Sea. All remarked that 'the aurora flashed forth in the most vivid beams when masses of cirrous strata were hovering in the upper regions of the air, and when these were so thin that their presence could only be recognised by the formation of a halo round the moon.' These clouds sometimes range themselves, even by day, in a similar manner to the beams of the aurora, and then disturb the course of the magnetic needle in the same manner as the latter. On the morning after every distinct nocturnal aurora, the same superimposed strata of clouds have still been observed that had previously been luminous. The apparently converging polar zones (streaks of clouds in the direction of the magnetic meridian), which constantly occupied my attention during my journeys on the elevated plateaux of Mexico, and in northern Asia, belong probably to the same group of diurnal phenomena.

Southern lights have often been seen in England by the intelligent and indefatigable observer, Dalton; and northern lights have been observed in the southern hemisphere as far as 45° latitude (as on the 14th of January 1831). On occasions that are by no means of rare occurrence, the equilibrium at both poles has been simultaneously disturbed. I have discovered with certainty that northern polar lights have been seen within the tropics in Mexico and Peru. We must distinguish between the sphere of simultaneous visibility of the phenomenon and the zones of the earth where it is seen almost nightly. Every

observer no doubt sees a separate aurora of his own, as he sees a separate rainbow. A great portion of the earth simultaneously engenders these phenomena of emanations of light. Many nights may be instanced in which the phenomenon has been simultaneously observed in England and in Pennsylvania, in Rome and in Pekin. When it is stated that auroras diminish with the decrease of latitude, the latitude must be understood to be magnetic, and as measured by its distance from the magnetic pole. In Iceland, in Greenland, Newfoundland, on the shores of the Slave Lake, and at Fort Enterprise in Northern Canada, these lights appear almost every night at certain seasons of the year, celebrating with their flashing beams, according to the mode of expression common to the inhabitants of the Shetland Isles, 'A merry dance in heaven.' Whilst the aurora is a phenomenon of rare occurrence in Italy, it is frequently seen in the latitude of Philadelphia ($39^{\circ} 57'$), owing to the southern position of the American magnetic pole. In the districts which are remarkable in the New Continent and the Siberian coasts for the frequent occurrence of this phenomenon, there are special regions or zones of longitude, in which the polar light is particularly bright and brilliant. The existence of local influences cannot therefore be denied in these cases. Wrangel saw the brilliancy diminish as he left the shores of the Polar Sea, about Nischne-Kolymsk. The observations made in the North Polar expedition appear to prove that in the immediate vicinity of the magnetic pole the development of light is not in the least degree more intense or frequent than at some distance from it.

MENSURATION.

To find the solid contents of a cube :—

- (1) Find the solid contents of a cube which is 5 ft. each way.
 - (2) What is the solid contents of a marble cube which is 7 ft. 6 in. each way?
 - (3) How many 3-in. cubes can be cut out of a cube of marble which is $3\frac{1}{2}$ ft. each way?
 - (4) What is the weight of a leaden cube which is 15 in. each way, the specific gravity of lead being 11.5, and the weight of a cubic foot of water 1000 ounces avoirdupois?
 - (5) What weight of water will a cubical cistern contain which is 4 ft. 5 in. each way?
-

SELF-HELP: NATIONAL AND INDIVIDUAL.

(From 'Self-Help,' by Mr. Smiles.)

stim'ul-us, <i>that which rouses the mind or spirits</i>	ex'tir-pate, <i>to root out</i>
le-gis-la-tion, <i>law-making</i>	rad'i-cal-ly, <i>originality, from the very roots</i>
func-tion, <i>office or duty</i>	pa'tri-ot-ism, <i>love of one's country</i>
neg'a-tive, <i>denying</i>	phil-an'tro-py, <i>love of mankind generally</i>
re-stric-tive, <i>limiting</i>	ig-no'bly, <i>meanly, dishonourably</i>
ab-o-lit-ion, <i>the doing away with a thing</i>	phan-tas-ma-go'-ri-a, <i>a magic lantern</i>
dis-e-nact-ments, <i>acts of parliament made to set aside others</i>	cha'-os, <i>confusion, matter before the Creation</i>
ag'-gre-gate, <i>the result of a number of considerations taken together</i>	pat'-ine, <i>the cover of a chalice or cup</i>

'HEAVEN helps those who help themselves,' is a well-tryed maxim, embodying in a small compass the results of vast human experience. The spirit of self-help is the root of all genuine growth in the individual, and exhibited in the lives of many, it constitutes the true source of national vigour and strength. Help from without is often enfeebling in its effects, but help from within invariably invigorates. Whatever is done for men or classes, to a certain extent takes away the stimulus and necessity of doing for themselves; and where men are subjected to over-guidance and over-government, the inevitable tendency is to render them comparatively helpless.

Even the best institutions can give a man no active aid. Perhaps the utmost they can do is to leave him free to develop himself and improve his individual condition. But in all times men have been prone to believe that their happiness and well-being were to be secured by means of institutions rather than by their own conduct.

Hence the value of legislation as an agent in human advancement has always been greatly over-estimated. To constitute the millionth part of a legislature, by voting for one or two men once in three or five years, however conscientiously this duty may be performed, can exercise but little active influence upon any man's life and character. Moreover, it is every day becoming more clearly understood, that the function of government is negative and restrictive, rather than positive and active, being resolvable principally into protection—protection of life, liberty, and property. Hence the chief 'reforms' of the last fifty years have consisted mainly in abolitions and disenactments. But there is no power of law that can make the idle man industrious, the thrifty less provident, or the drunkard sober, though any individual can be each and all of these, if he will, by the exercise of his own free powers of action and self-denial. Indeed, all experience serves to prove that the worth

and strength of a state depend far less upon the form of its institutions than upon the character of its men. For the nation is only the aggregate of individual conditions, and civilisation itself is but a question of personal improvement.

National progress is the sum of individual industry, energy, and uprightness, as national decay is of individual idleness, selfishness, and vice. What we are accustomed to decry as great social evils, will, for the most part, be found to be only the outgrowth of our own perverted life; and though we may endeavour to cut them down and extirpate them by means of law, they will only spring up again with fresh luxuriance in some other form, unless the conditions of human life and character are radically improved. If this view be correct, then it follows that the highest patriotism and philanthropy consist not so much in altering laws and modifying institutions, as in helping and stimulating men to elevate and improve themselves by their own free and independent action. The government of a nation itself is usually found to be but the reflex of the individuals composing it. The government that is ahead of the people will be inevitably dragged down to their level, as the government that is behind them will in the long run be dragged up. In the order of nature, the collective character of a nation will as surely find its befitting results in its law and government, as water finds its own level. The noble people will be nobly ruled, and the ignorant and corrupt, ignobly. Indeed, liberty is quite as much a moral as a political growth—the result of free individual action, energy, and independence. It may be of comparatively little consequence how a man is governed from without, whilst everything depends upon how he governs himself from within. The greatest slave is not he who is ruled by a despot, great though that evil be, but he who is the thrall of his own moral ignorance, selfishness, and vice. There have been, and perhaps there still are, so-called patriots abroad, who hold it to be the greatest stroke for liberty to kill a tyrant, forgetting that the tyrant usually represents only too faithfully the millions of people over whom he reigns. But nations who are enslaved at heart cannot be freed by any mere changes of masters or of institutions; and so long as the fatal delusion prevails, that liberty solely depends upon and consists in government, so long will such changes, no matter at what cost they be effected, have as little practical and lasting results as the shifting of the figures in a phantasmagoria. The solid foundations of liberty must rest upon individual character; which is also the only sure guarantee for social security and national progress. In this consists the real strength of English liberty. Englishmen feel that they are free, not merely because they live under those free institutions which they have

laboriously built up, but because each member of society has to a greater or less extent got the root of the matter within himself; and they continue to hold fast and enjoy their liberty, not by freedom of speech merely, but by their steadfast life and energetic action as free individual men.

Such as England is, she has been made by the thinking and working of many generations; the action of even the least significant person having contributed towards the production of the general result. Laborious and patient men of all ranks—cultivators of the soil and explorers of the mine—inventors and discoverers—tradesmen, mechanics, and labourers—poets, thinkers, and politicians—all have worked together, one generation carrying forward the labours of another, building up the character of the country, and establishing its prosperity on solid foundations. This succession of noble workers—the artizans of civilisation—has created order out of chaos, in industry, science, and art: and as our forefathers laboured for us, and we have succeeded to the inheritance which they have bequeathed to us, so is it our duty to hand it down, not only unimpaired, but improved, to our successors. This spirit of self-help, as exhibited in the energetic action of individuals, has in all times been a marked feature in the English character, and furnishes the true measure of our power as a nation. Rising above the heads of the mass, there have always been a series of individuals distinguished beyond others, who have commanded the public homage. But our progress has been owing also to multitudes of smaller and unknown men. Though only the generals' names may be remembered in the history of any great campaign, it has been mainly through the individual valour and heroism of the privates that victories have been won. And life, too, is 'a soldier's battle,' men in the ranks having in all times been amongst the greatest of workers. Many are the lives of men, unwritten, which have nevertheless as powerfully influenced civilisation and progress as the more fortunate great whose names are recorded in biography. Even the humblest person, who sets before his fellows an example of industry, sobriety, and upright honesty of purpose in life, has a present as well as a future influence upon the well-being of his country; for his life and character pass unconsciously into the lives of others, and propagate good example for all time to come.

Biographies of great, but especially of good men, are, nevertheless, most instructive and useful, as helps, guides, and incentives to others. Some of the best are almost equivalent to gospels—teaching high living, high thinking, and energetic action for their own and the world's good. British biography is studded over, as with 'patines of bright gold,' with illus-

trious examples of the power of self-help, of patient purpose, resolute working, and steadfast integrity, issuing in the formation of truly noble and manly character; exhibiting in language not to be misunderstood, what it is in the power of each to accomplish for himself; and illustrating the efficacy of self-respect and self-reliance in enabling men of even the humblest rank to work out for themselves an honourable competency and a solid reputation.

MENSURATION.

To find the solid content of a parallelepipedon:—

- (1) A piece of timber is 25 ft. long, 10 in. broad, and 9 in. deep; what is its solid content?
- (2) What is the solid content of a piece of timber 25 in. square at the ends, and 40 ft. long?
- (3) What length must be cut off a piece of timber 15 in. square at each end to measure 5 cubic feet?
- (4) How many cubic feet are contained in a block of marble which measures 7 ft. 6 in. in length, 3 ft. 2 in. in breadth, and 1 ft. 3 in. in thickness?
- (5) What is the weight of an iron beam 35 ft. long, 18 in. wide, and 14 in. thick, its specific gravity being 7·8?

SPRINGS, CAVES, OIL-WELLS, ETC.

(From 'Physical Geography,' by Sir John Herschel.)

con-verge', to tend to one point
 sol'-vent (adj.), having the power of
 dissolving or dividing
 sub-ter-ra'-ne-ous, being under the earth's
 surface
 re-spec'-tive-ly, as belonging to each
 a-nal'-y-sis, the separation of a com-
 pound into the parts of which it consists
 sul'-phu-ret'-ed, combined with sulphur

per'-co-late, to strain through, to filter
 phe-nom'-e-non (Gr.), plu. phenomena,
 an appearance, anything remarkable
 hy-dro-stat'-ic, relating to water, or any
 fluids, in a state of rest
 lu'-bri-cate, to make smooth, or slippery
 car'-bu-ret'-ed, containing carbon
 in-ter-mit', to cease for a time

THE welling forth of streams from perennial springs is of the most ordinary occurrence, but it is seldom more than a rivulet which rises in this manner. There are, however, some instances of considerable streams so originating. When this is the case they issue from caverns, and these occur usually either in ice or in limestone. In the former case, they are evidently only the drainage of melted snow, which pours out at the foot of a glacier by the contribution of subglacial streams converging to the lowest point. Such is the source of the Arve, from the Glacier des Bois, at Chamouni; and such that of the Ganges, which emerges as a stream, already forty yards in breadth, from a huge cavern in a perpendicular wall of ice near the

temple of Gangutri. Limestone formations are very apt to be hollowed into caverns by the solvent power of carbonic, and perhaps also of other acids derived from vegetable decomposition, held in solution in the percolating water. Such caverns often run to great distances under ground, and frequently contain running streams, even considerable rivers, as is the case in the caverns of the Peak and Castleton in Derbyshire, and in that of the Nicojack Cave in Georgia, U.S., on the Tennessee river, where a waterfall occurs, at a distance of three miles under ground. When such streams emerge to-day, we have the phenomenon in question, as in the cavern of the Gaucheros, in the valley of Caripe, in Cumana, described by Humboldt; in the celebrated fountain of Vaucluse, which issues as a considerable stream from a cave at the foot of a perpendicular limestone cliff; and in a great number of caves in Carniola and Illyria, where 'almost every lake or river has a subterraneous source, and often a subterraneous exit. The Laibach river rises twice from the limestone rock, and is twice again swallowed up by earth before it makes its final appearance.'* The rivers Sarapa and Blanco, which flow from the lake of Yojoa, in Honduras, both enter subterraneous channels, through which having passed, in the one case a mile, and in the other a mile and a half under ground, they reappear. When water, carried down to a great depth into the earth, is forced up again by hydrostatic pressure through other channels, and rises as a spring, it brings up the temperature of the greatest depth to which it has penetrated, and that sometimes a very high one, even out of the neighbourhood of any volcanic formation. The warm springs at Bath have a temperature from 93° to 117° Fahr., those of Bareges and Bagneres 120° and 123° . In the county of Bath, in Virginia, a 'warm spring' issues in sufficient volume to turn a mill, and a 'hot spring' rises at a few miles' distance. Three springs at Yom Mat, near Macao, have temperatures of 132° , 150° , and 186° Fahr. respectively. On the Arkansas river are springs of 180° and 190° ; at Broussa, in Asia Minor, the water rises scalding hot; at La Trinchera, near Valencia, 194.5° , in a stream 2 feet deep and 18 feet broad; at Jumnotri, in the Himalaya, nearly boiling; at Urijino, in Japan, fully boiling; and in the Geyser fountains at Reikiavik, in Iceland, it is spouted intermittently, in a torrent, to the height of 150 to 200 feet, actually boiling. In this case there can be no doubt of its having traversed a bed of lava not yet cold. A simple and perfect imitation of the phenomenon is produced by heating the stem of a tobacco-pipe red hot, and holding it horizontal, the bowl being filled with cold water.

* Davy.

If we consider that the temperature of the earth increases at an average rate of about 1° Fahr. for every ninety feet of depth, these facts will not appear at all surprising. The permanence of their temperature is a proof of their obtaining it at great depths. At Mont Dor the very bath exists which was constructed in the time of Cæsar. At Yakutsk, where the soil is frozen to a depth of 690 feet, Mr. Atkinson informs us that hot springs exist, and afford in their neighbourhood opportunities of culture.

Many springs rise impregnated with carbonic acid,—those of Carlsbad to the amount of 12 cubic inches to the pint, and that of Bilin 34 inches. The warm spring of Wildbad, in Wirttemberg, contains in a pint of water 12 cubic inches of carbonic acid, 7.9 of azote, and 8 of oxygen. Sulphuretted hydrogen also is no uncommon ingredient, as in the sources of Baden, Harrogate, and St. Arlmand. Saline ingredients often enter to a large extent, and springs of brine occur in many localities, as at Droitwich, in Worcestershire; at Halle, in Saxony; and at Luneberg. Other salts of soda also occur in abundance; thus the springs of Carlsbad alone have been computed (from analysis) to give out annually more than 13,000,000 lbs. of carbonate, and 20,000,000 lbs. of sulphate of that alkali. Borax is found in the lakes of Thibet, and free boracic acid in the Lagune of Tuscany. Lime and magnesia enter as muriate and sulphate. Silica occurs in the boiling springs of the Geysers.

Springs of petroleum and naphtha occur in Zante, in Modena, and Parma, in Sicily, and many other localities. In the Burmese territory, on the Irawadi, there are upwards of 500 wells yielding annually 400,000 hogsheads of petroleum. In Trinidad there is a lake of mineral pitch three miles in circumference, partly liquid, partly solid, and fluid bitumen rises through the sea near that island. Petroleum wells have recently been opened over a very extensive district in North America, near Cleveland, Ohio, and on the banks of Oil Creek, a branch of the Alleghany River, in Erie county, Pennsylvania; also at 'Tidionte,' in Warren county, where are seventeen wells stated to yield the almost incredible quantity of 10,000 gallons a day. The oil is pumped up with water from shallow wells, mere pits, and, floating on the surface, is collected. It is stated to burn well, and to be highly lubricating.

Carburetted hydrogen gas is discharged from the earth in many regions where coal abounds. At Fredonia, in New York, U.S., it is conveyed in pipes for lighting and domestic use. In the province of Tsechuan, in China, it is also so used. At Tsee-lieou-tsing, a single source of gas heats 300 kettles. At Pietra Mala, near Florence, carburetted hydrogen rises

through limestone, and may be set on fire. At Bacou, on the Caspian, flames (doubtless owing to gas on fire) are often observed to run over the hills. Something of the same kind is said to occur in the country between Namur and Liege. Springs occasionally intermit and flow again in regularly recurring periods. That of Paderborn, in Westphalia, discharges water twice in the twenty-four hours—the discharge being accompanied with a loud rumbling noise. The cave of Kilcorney, county Clare, in Ireland, generally dry, discharges a great flood of water quite suddenly two or three times in the year. The lake of Zirknitz, near Trieste, is half the year a hay-field, and the other half full of water discharged from a limestone cavern.

MENSURATION.

To find the convex surface of a cylinder :—

- (1) What is the area of the convex surface of a cylinder whose circumference is 10 ft., and whose height is 32 ft.?
- (2) How many yards of cloth 22 in. wide will be required to cover a cylinder of which the diameter is 2 ft. 6 in., and height 7 ft. 9 in.?

To find the solid content of a cylinder :—

- (3) What is the solid content of a cylinder whose height is 25 ft., and the diameter of whose base is 10 ft.?
- (4) What is the length of a cylinder whose diameter is 18 in., and whose solid content is 10 cubic feet?
- (5) What weight of water can be contained in a cylinder whose height is 10 ft., and the circumference of whose base is 20 ft.?

THE BATTLE OF CULLODEN.

(From the 'History of England,' by Lord Mahon.)

1746.

[By the Act of Settlement, the Crown, on the death of Queen Anne, devolved on George, Elector of Hanover, who became King A.D. 1714. The House of Stuart, however, had a strong party in their favour, especially in Scotland, and an unsuccessful attempt was made in behalf of James (the Pretender), son of James II., in 1715. Circumstances seemed to favour the hopes of this (the Jacobite) party again in 1745, when the young Pretender, Charles, son of James, landed in Scotland, and was received by the Highlanders with open arms. He invaded England, won the battle of Prestonpans, and seemed likely to meet with success in his enterprise, until a division among his followers compelled him to retreat from Derby, to which town he had advanced. The King's army, which was on the march to meet him, pursued, and the opposing forces met at Culloden, where Charles's army was entirely and irretrievably routed.]


The battle began with a cannonade on both sides, by which (so different was the skill of their artillerymen) the royal army

suffered little, but the insurgent, greatly. Of the rival princes, William at once took up his position between the first and second lines; Charles, before repairing to his, rode along the ranks to animate the men. His little party soon became a conspicuous mark for the enemy's cannon; several of his guardsmen fell, and a servant, who held a led horse, was killed by his side, the prince himself being covered by the earth thrown up by the ball. Not discomposed, however, he coolly continued his inspection, and then, as at Falkirk, stationed himself on a little height just behind the second line. Meanwhile, a storm of snow and hail had begun to fall, but, unlike that at Falkirk, blowing full in the faces of the Highlanders. At length, Lord George Murray, finding his division of the right lose so much more than they inflicted from the cannonade, sent Colonel Ker of Gradon to the prince, requesting permission to attack. This being granted, the right wing and centre, with one loud shout, rushed furiously forward, sword in hand; they were received with a rolling fire, both of cannon and grapeshot, but yet so resistless was their onset that they broke through Monro's and Burrel's regiments in the first line, and captured two pieces of cannon. But the duke, foreseeing the chance of this event, and with a view to provide against it, had carefully strengthened and stationed his second line; it was drawn up three deep, the front rank kneeling, the second bending forward, the third standing upright. These, reserving their fire till the Highlanders were close upon them, poured in a volley so well sustained and destructive as completely to disorder them. Before they could recover, the royal troops improved the advantage, and, driving the clans together till they became one mingled mass, turned them from assailants into fugitives. Some of their best DUNNIE VASSALLS and the Chief of Mac Lauchlan were killed and trampled down; the brave Lochiel fell wounded, but was carried from the field by his two henchmen; and the call of the other chiefs arose unheeded and overborne. In short, the whole right and centre of the insurgents were now in irretrievable rout, pursued by superior numbers, and dropping from previous exhaustion.

Yet let it not be deemed that even thus their courage failed. Not by their forefathers at Bannockburn—not by themselves at Preston or at Falkirk—not in after years when discipline had raised and refined the valour of their sons—not on the shores of the Nile—not on that other field of victory where their gallant chief, with a prophetic shroud (it is their own superstition) high upon his breast, addressed to them only these three words, 'HIGHLANDERS, REMEMBER EGYPT'—not in those hours of triumph and of glory was displayed a more firm and resolute bravery than now in the defeat at Culloden. The right and

the stocks of their muskets. One farm-building, into which some twenty disabled Highlanders had crawled, was deliberately set on fire the next day, and burned with them to the ground. The native prisoners were scarcely better treated; and even sufficient water was not vouchsafed to their thirst. 'I myself,' says a gentleman of Inverness, 'have often gone by the prison at that melancholy time, when I heard the prisoners calling out for water in the most pitiful manner.' To palliate these severities, it was afterwards said in the royal army, that an order had been found, in Lord George Murray's writing, that the Highlanders if victorious should give no quarter. But this pretended order was never shown or seen; it is utterly at variance with the insurgents' conduct in their previous battles; and was often and most solemnly denied by their prisoners.

From the field of Culloden Charles had rode away with Sheridan, O'Sullivan, and other horsemen, to Gortuleg, where Lord Lovat was residing. It was the first and last meeting between them; but small was the sympathy or consolation which the young prince received from the hoary, and now despairing, intriguer. While Charles exclaimed on the ruin of the cause, Lovat thought only of his own; he forgot even the common courtesy of a host, and they parted in mutual displeasure. Resuming his flight at ten o'clock the same evening, Charles and his little party rode rapidly on to Glengarry's Castle of Invergarry, where they arrived two hours before day-break of the 17th, so utterly exhausted that they could only throw themselves upon the floor in their clothes. The success of a fisherman, who went out and caught two salmon from the neighbouring brook, afforded their only chance of food; nor was there any other beverage than the same brook supplied. Yet how slight were these hardships compared to those which followed! There was still some prospect of rallying an army at Ruthven, to which about 1,200 fugitives from Culloden had repaired, directed by the talent and animated by the spirit of Lord George Murray. But the want of supplies of all kinds—the terror of the recent battle—the growing dispersion—and the far superior forces of the enemy at hand—ere long dispelled these lingering hopes. Lord George, indeed, was still for persevering at all hazards, but a message was received from Charles, thanking the gentlemen present for their zeal, but urging them to do only what each might think best for his own safety, and they accordingly dispersed. And thus was the Rebellion finally extinguished.



MENSURATION.

To find the surface of a right cone or a pyramid :—

- (1) What is the convex surface of an upright cone whose diameter is 4·5 ft., and the slant height 20 ft.?
 - (2) Required the whole surface of a rectangular pyramid whose base is 17 ft. by 15 ft. 6 in., and whose slant height is 34 ft.
- To find the solid content of a right cone or pyramid :—
- (3) What is the solid content of a cone, the diameter of whose base is 18 in., and whose perpendicular height is 15 ft.?
 - (4) What is the weight of a square pyramid of copper, each side of whose base is 6 in., and whose height is 5 in., the specific gravity of copper being 8·95?
 - (5) Find the solid content of a triangular cone, each of whose sides and whose height are 5 ft.

' THE STARRY GALILEO ; ' THE INVENTION OF THE TELESCOPE.

(From ' Stories of Inventors and Discoverers in Science and the Useful Arts, by J. Timbs, F.S.A.)

op'-ti-cal, relating to the science of optics
 con'-vex, the opposite of concave; the
 rising in a circular form at the outside
 of a globe
 ep-i-dem'-i-cal, affecting the people in
 large numbers
 ap-pel-la'-tion, name, title
 a-s'-ro-naut, one who sails through the
 air
 plei'-a-des, a cluster of stars
 pre-dict', to foretell
 li'-brate (v.), to poise, to balance
 li-bra'-tion, an apparent irregularity in
 the moon's motion, by which she seems
 to librate about her axis, sometimes

from east to west and sometimes from
 west to east
 re-fra'-tion, the variation, or deviation,
 from a direct line of a ray of light
 oon-cave', hollow
 suc-ces'-sive-ly, in uninterrupted order
 sem-i-di-am'-e-ter, half a diameter
 sat'-el-lite, a small or secondary planet
 revolving round a larger, as the moon
 round the earth
 grav-i-ta'-tion, the act of tending, by at-
 traction, to the centre
 con-tem'-po-ra-ry, one who lives at the
 same time with another
 ir-rep'-a-rab-ly, without recovery

It was in the month of April or May 1609, that a rumour, creeping through Europe by the tardy messengers of former days, at length found its way to Venice, where Galileo was on a visit to a friend, that a Dutchman had presented to Prince Maurice of Nassau an optical instrument, which possessed the singular property of causing distant objects to appear nearer to the observer. This Dutchman was Hans, or John Sippershey, who, as has been clearly proved by the late Professor Moll, of Utrecht, was in possession of a telescope made by himself so early as October 1608. A few days afterwards, this report was confirmed in a letter from James Badorere, at Paris, to Galileo, who immediately applied himself to the consideration of the subject. On the first night after his return to Padua, he found

in the doctrines of refraction, the principle which he sought. Having procured two spectacle-glasses, both of which were plane on one side, while one of them had its other side convex, and the other its second side concave, he placed one at each end of a leaden tube a few inches long; and having applied his eye to the concave glass, he saw objects pretty large, and pretty near him. This little instrument, which magnified only three times, and which he held between his fingers or laid in his hand, he carried to Venice, where it excited the most intense interest. Crowds of the principal citizens flocked to his house to see the magical toy; and after nearly a month had been spent in gratifying this epidemical curiosity, Galileo was led to understand from Leonardo Deodati, the Doge of Venice, that the Senate would be highly gratified by obtaining possession of so extraordinary an instrument. Galileo instantly complied with the wishes of his patrons, who acknowledged the present by a mandate, conferring upon him for life his professorship at Padua, and raising his salary from 520 to 1000 florins.

The interest which the exhibition of the telescope excited at Venice did not soon subside; Sirturi describes it as amounting to frenzy. When he himself had succeeded in making one of these instruments, he ascended the Tower of S. Mark, where he might use it without molestation. He was recognised, however, by a crowd in the street; and such was the eagerness of their curiosity, that they took possession of the wondrous tube, and detained the impatient philosopher for several hours, till they had successively witnessed its effects. Desirous of obtaining the same gratification for their friends, they endeavoured to learn the name of the inn at which Sirturi lodged; but he, overhearing their enquiries, quitted Venice early next morning.

The opticians speedily availed themselves of this wonderful invention. Galileo's tube, or the double eye-glass, or the cylinder, or the trunk, as it was called—for Demisiano had not yet given it the appellation of *telescope*—was manufactured in great numbers and in a very inferior manner. The instruments were purchased merely as philosophical toys, and were carried by travellers into every corner of Europe. The art of grinding and polishing lenses was at this time very imperfect. Galileo, and those whom he instructed, were alone capable of making tolerable instruments. In 1634, a good telescope could not be procured in Paris, Venice, or Amsterdam; and even in 1637, there was not one in Holland which could show Jupiter's disk well defined.

After Galileo had completed his first instrument, which *magnified only three times*, he executed a larger and better one, *with a power of about eight*. 'At length,' as he himself re-

marks, 'sparing neither labour nor expense,' he constructed a telescope so excellent that it bore a magnifying power of more than *thirty* times.

Thus was Galileo equipped for a survey of the heavens. The first celestial object to which he directed his telescope was the moon, which, to use his own words, appeared as near as if it had been distant only two semi-diameters of the earth. It displayed to him her mountain ranges and her glens, her continents and her highlands, now lying in darkness, now brilliant with sunshine, and undergoing all those variations of light and shadow which the surface of our own globe presents to the Alpine traveller or to the *aéronaut*. The four satellites of Jupiter illuminating their planet, and suffering eclipses in their shadow like our own moon; the spots on the sun's disk, proving his rotation round his axis in twenty-five days; the crescent phases of Venus; and the triple form, or the imperfectly developed ring of Saturn, were the other discoveries in the solar system which rewarded the diligence of Galileo. In the starry heavens, too, thousands of new worlds were discovered by his telescope; and the Pleiades alone, which, to the unassisted eye, exhibits only *seven* stars, displayed to Galileo no fewer than *forty*.

It was then that, to his unutterable astonishment, Galileo saw, as a celebrated French astronomer (M. Biot) has expressed it, 'what no mortal before that moment had seen—the surface of the moon, like another earth, ridged by high mountains and furrowed by deep valleys; Venus, as well as it, presenting phases demonstrative of a spherical form; Jupiter surrounded by four satellites, which accompanied him in his orbit; the milky way; the nebulae; finally, the whole heavens sown over with an infinite multitude of stars, too small to be discerned by the naked eye.' Milton, who had seen Galileo, nearly half a century after the invention, refers to some of the wonders thus laid open by the telescope:—

The moon, whose orb,
Through optic glass the Tuscan artist views
At evening from the top of Fesolè,
Or in Valdarno, to descry new lands,
Rivers, or mountains, in her spotty globe.

'There are,' says Everett, the American orator, 'occasions in life in which a great mind lives years of rapt enjoyment in a moment. I can fancy the emotions of Galileo, when, first raising the newly-constructed telescope to the heavens, he saw fulfilled the grand prophecy of Copernicus, and beheld the planet Venus crescent like the moon. It was such another moment as that when the immortal printers of Mentz and

Strasburg received the first copy of the Bible into their hands, the work of their divine art; like that when Columbus, through the grey dawn of October 12, 1492 (Copernicus, at the age of eighteen, was then a student at Cracow), beheld the shores of San Salvador; like that when the law of gravitation first revealed itself to the intellect of Newton; like that when Franklin saw, by the stiffening of the fibres of the hempen cord of his kite, that he held the lightning in his grasp; like that when Leverrier received back from Berlin the tidings that the predicted planet was found.'

'The starry Galileo,' with his woes, is enshrined among 'the martyrs of science.' His noblest discoveries were the derision of his contemporaries, and were even denounced as crimes which merited the vengeance of Heaven. He was the victim of cruel persecution, and spent some of his latest hours within the walls of a prison; and, though the Almighty granted him, as it were, a new sight, to discern unknown worlds in the obscurity, yet the eyes which were allowed to witness such wonders were themselves doomed to be closed in darkness. Sir David Brewster eloquently says:—

'The discovery of the moon's libration was the result of the last telescopic observations of Galileo. Although his right eye had for some years lost its power, yet his general vision was sufficiently perfect to enable him to carry on his usual researches. In 1636, however, this affection of his eye became more serious; and in 1637 his left eye was attacked by the same disease; the disease turned out to be in the cornea, and every attempt to restore its transparency was fruitless. In a few months, the white cloud covered the whole aperture of the pupil, and Galileo became totally blind. This sudden and unexpected calamity had almost overwhelmed Galileo and his friends. In writing to a correspondent, he exclaims, "Alas, your dear friend and servant has become totally and irreparably blind. Those heavens, this earth, this universe, which by wonderful observation I had enlarged a thousand times beyond the belief of past ages, are henceforth shrunk into the narrow space which I myself occupy. So it pleases God; it shall, therefore, please me also." Galileo's father, Father Castelli, deploras the calamity in the same tone of pathetic sublimity: "The noblest eye," says he, "which nature ever made, is darkened; an eye so privileged, and gifted with such rare powers, that it may truly be said to have seen more than the eyes of all that are gone, and to have opened the eyes of all that are to come."

MENSURATION.

To find the convex surface of a sphere :—

- (1) What is the convex surface of a sphere whose diameter is 20 in. ?
- (2) What is the area of the earth's surface, calculating its diameter at 7957·75 miles ?
- (3) What is the diameter of a ball, the area of whose surface is one square foot ?

To find the solid content of a sphere :—

- (4) What is the solid content of a sphere whose diameter is 10 in. ?
- (5) What is the weight of a solid globe of silver which is 6 in. in diameter, the specific gravity of silver being 10·3 ?
- (6) What would be the value of a golden sphere of 1 in. in diameter at £3 15s. per ounce, the specific gravity of gold being 19·5 ?

SELECTIONS FROM THE POEMS OF SCOTT,
BYRON, AND BURNS.

DEATH OF DE ARGENTINE.

(Sir Walter Scott.)

[Born, 1771; died, 1832. Chief works: 'Lay of the Last Minstrel,' 'Marmion,' 'The Lady of the Lake,' 'The Lord of the Isles,' 'Rokeby,' 'Bridal of Triermain,' the 'Waverley Novels,' &c. &c.]

rereward, towards the rear
gage (n.), a pledge
goal, a final end or object
couch (v.), to fix a spear in rest
raze, to overthrow, to strike off

cush, the armour that covers the thigh
rav-age, to waste, to destroy
ar-ma-ment, a land or naval force
ar'-hi-ter, an umpire
glint, to glisten

ALREADY scattered o'er the plain,
Reproof, command, and counsel vain,
The rereward squadrons fled amain,
Or made but doubtful stay;
But when they marked the seeming show
Of fresh and fierce and marshalled foe,
The boldest broke array.
O give their hapless prince his due!
In vain the royal Edward threw
His person 'mid the spears,
Cried, 'Fight!' to terror and despair,
Menaced, and wept, and tore his hair,
And cursed their caitiff fears;
Till Pembroke turned his bridal rein,
And forced him from the fatal plain.
With them rode Argentine, until

They gained the summit of the hill,
But quitted there the train :—
'In yonder field a gage I left,—
I must not live of fame bereft ;
I needs must turn again.
Speed hence, my liege, for on your trace
The fiery Douglas takes the chase,—
I know his banner well.
God send my sovereign joy and bliss,
And many a happier field than this !
Once more, my liege, farewell.

Again he faced the battle-field,—
Wildly they fly, are slain, or yield.
'Now then,' he said, and couched his spear,
'My course is run, the goal is near ;
One effort more, one brave career,
Must close this race of mine.
Then in his stirrups rising high,
He shouted loud his battle-cry,
'Saint James for Argentine .
And of the bold pursuers, four
The gallant knight from saddle bore ;
But not unharmed,—a lance's point
Has found his breastplate's loosened joint,
An axe has razed his crest ;
Yet still on Colonsay's fierce lord,
Who pressed the chase with gory sword,
He rode with spear in rest,
And through his bloody tartans bored,
And through his gallant breast.
Nailed to the earth, the mountaineer
Yet writhed him up against the spear,
And swung his broadsword round !
Stirrup, steel-boot, and cuish gave way,
Beneath that blow's tremendous sway,
The blood gushed from the wound ;
And the grim lord of Colonsay
Hath turned him on the ground,
And laughed in death-pang, that his blade
The mortal thrust so well repaid.

Now toiled the Bruce, the battle done,
To use his conquest, boldly won ;
And gave command for horse and spear
To press the Southron's scatter'd rear,
Nor let his broken force combine,

When the war-cry of Argentine
 Fell faintly on his ear!
 'Save, save his life,' he cried, 'O save
 The kind, the noble, and the brave!'
 The squadrons round free passage gave,
 The wounded knight drew near.
 He raised his red-cross shield no more,
 Helm, cuish, and breastplate streamed with gore,
 Yet, as he saw the King advance,
 He strove e'en then to couch his lance—

The effort was in vain!
 The spur-stroke failed to rouse the horse;
 Wounded and weary, in mid-course
 He stumbled on the plain.

Then foremost was the generous Bruce
 To raise his head, his helm to loose:
 'Lord Earl, the day is thine!
 My Sovereign's charge, and adverse fate,
 Have made our meeting all too late:
 Yet this may Argentine,
 As boon from ancient comrade, crave—
 A Christian's mass, a soldier's grave!'

Bruce pressed his dying hand—its grasp
 Kindly replied: but, in his clasp,
 It stiffened and grew cold.
 And, 'Oh, farewell!' the victor cried,
 'Of chivalry the flower and pride,
 The arm in battle bold,
 The courteous mien, the noble race,
 The stainless faith, the manly face!
 Bid Ninian's convent light their shrine,
 For late-wake of De Argentine.
 O'er better knight on death-bier laid,
 Torch never gleamed nor mass was said!'

Nor for De Argentine alone
 Through Ninian's church these torches shone,
 And rose the death-prayer's awful tone.
 That yellow lustre glimmered pale,
 On broken plate and bloodied mail,
 Rent crest and shattered coronet,
 Of baron, earl, and banneret;
 And the best names that England knew,
 Claimed in the death-prayer dismal due.

Yet mourn not, land of fame!
 Though ne'er the leopards on thy shield

Retreated from so sad a field,
 Since Norman William came,—
 Oft may thine annals justly boast
 Of battles stern by Scotland lost;
 Grudge not her victory,
 When for her freeborn rights she strove;
 Rights dear to all who freedom love,
 To none so dear as thee!

Lord of the Isles.

APOSTROPHE TO THE OCEAN.

(*Lord Byron.*)

[Born, 1788; died, 1824. Chief works: 'Hours of Idleness,' 'English Bard and Scotch Reviewers,' 'Childe Harold,' 'The Giaour,' 'The Bride of Abydos,' 'The Corsair,' 'Lara,' 'Manfred,' 'Don Juan,' 'Prisoner of Chillon,' &c.]

There is a pleasure in the pathless woods,
 There is a rapture on the lonely shore,
 There is society where none intrudes,
 By the deep sea, and music in its roar;
 I love not man the less, but nature more,
 From these our interviews, in which I steal
 From all I may be, or have been before,
 To mingle with the universe, and feel
 What I can ne'er express, yet cannot all conceal.
 Roll on thou deep, and dark blue Ocean, roll!
 Ten thousand fleets sweep over thee in vain,
 Man marks the earth with ruin—his control
 Stops with the shore; upon the watery plain
 The wrecks are all thy deed, nor doth remain
 A shadow of man's ravage, save his own,
 When, for a moment, like a drop of rain,
 He sinks into thy depths with bubbling groan,
 Without a grave, unknelt, uncoffined, and unknown!

His steps are on thy paths—thy fields
 Are not a spoil for him—thou dost arise
 And shake him from thee; the vile strength he wields
 For earth's destruction thou dost all despise,
 Spurning him from thy bosom to the skies,
 And send'st him, shivering in thy playful spray,
 And howling to his gods, where haply lies,
 His petty hope in some near port or bay,
 And dashest him again to earth: there let him lay!

The armaments which thunderstrike the walls
 Of rock-built cities, bidding nations quake

And monarchs tremble in their capitals,—
 The oak leviathans, whose huge ribs make
 Their clay creator the vain title take
 Of lord of thee, and arbiter of war :
 These are thy toys, and as the snowy flake,
 They melt into thy yeast of waves, which mar
 Alike the Armada's pride, or spoils of Trafalgar,

Thy shores are empires, changed in all save thee—
 Assyria, Greece, Rome, Carthage, where are they ?
 Thy waters wasted them while they were free,
 And many a tyrant since ; their shores obey
 The stranger, slave, or savage, their decay,
 Has dried up realms to deserts : not so thou ;
 Unchangeable save to thy wild waves' play,
 Time writes no wrinkle on thine azure brow ;
 Such as creation's dawn beheld, thou rollest now,

Thou glorious mirror, where the Almighty's form
 Glasses itself in tempests ; in all time,
 Calm or convulsed—in breeze, or gale, or storm,
 Icing the pole, or in the torrid clime,
 Dark-heaving ; boundless, endless, and sublime—
 The image of Eternity—the throne
 Of the Invisible ; even from out thy slime
 The monsters of the deep are made ; each zone
 Obeys thee ; thou goest forth, dread, fathomless, alone !

And I have loved thee, Ocean ! and my joy
 Of youthful sports was on thy breast to be
 Borne, like thy bubbles, onward : from a boy
 I wantoned with thy breakers—they to me
 Were a delight ; and if the freshening sea
 Made them a terror—'twas a pleasing fear ;
 For I was as it were a child of thee,
 And trusted to thy billows far and near,
 And laid my hand upon thy mane—as I do here.

Childe Harold.

TO A MOUNTAIN DAISY,

On turning one down with the plough in April 1786.

(*Robert Burns.*)

[Born, 1759 ; died, 1796. Chief works : 'Cotter's Saturday Night,' 'Tam O'Shanter,' 'The Jolly Beggars,' &c.]

Wee modest crimson-tipped flower,
 Thou's met me in an evil hour ;

For I maun crush amang the stoure,
Thy slender stem:
To spare thee now is past my power,
Thou bonnie gem.

Alas ! it's no thy neibor sweet,
The bonnie lark, companion meet,
Bending thee 'mang the dewy weat !
Wi' speckled breast,
When upward-springing, blithe, to greet
The purpling east.

Could blew the bitter-biting north
Upon thy early humble birth :
Yet cheerfully thou glinted forth
Amid the storm,
Scarce reared above the parent earth
Thy tender form.

The flaunting flowers our gardens yield,
High sheltering woods and wa's maun shield,
But thou, beneath the random bield
O' clod or stane,
Adorns the histie stubble-field,
Unseen, alane.

There in thy scanty mantle clad,
Thy snowy bosom sunward spread,
Thou lifts thy unassuming head
In humble guise ;
But now the share upturns thy bed,
And low thou lies.

Such is the fate of artless maid,
Sweet floweret of the rural shade !
By love's simplicity betrayed,
And guileless trust,
Till she, like thee, all soiled is laid,
Low i' the dust.

Such is the fate of simple bard,
On life's rough ocean, luckless starred !
Unskilful he to note the card
Of prudent lore,
Till billows rage, and gales blow hard,
And whelm him o'er !

Such fate to suffering worth is given,
Who long with wants and woes has striven,

By human pride or cunning driven
 To misery's brink,
 Till wrenched of every stay but Heaven,
 He, ruined, sink !

Even those who mourn 'st the daisy's fate,
 That fate is thine—no distant date,
 Stern ruin's ploughshare drives, elate,
 Full on thy bloom,
 Till crushed beneath the furrow's weight,
 Shall be thy doom.

MENSURATION.

Bricklayers' work measured by the rod :—

- (1) How many rods of brickwork are there in a wall $48\frac{1}{2}$ ft. long, $12\frac{1}{2}$ ft. high, and $2\frac{1}{2}$ bricks thick ?
- (2) How many rods of brickwork are there in a wall 65 ft. long, 13 ft. 10 in. high, and $2\frac{1}{2}$ bricks thick ?
- (3) If a wall be 985 ft. long, 6 ft. high, and $3\frac{1}{2}$ bricks thick, what will it cost at £2 10s. 6d. per rod ?
- (4) How many rods are contained in a room 35 ft. long, 11 ft. high, 18 ft. broad, the gable at the ends measuring 9 ft. 6 in. in height, and the walls being $1\frac{1}{2}$ brick thick ? And what will it cost at £3 2s. per rod ?

THE INFLUENCE OF THE GULF STREAM ON CLIMATE AND COMMERCE.

(From the 'Physical Geography of the Sea,' by Captain Maury.)

ap-prox'-i-mate (v.), to draw near to
 tor'-rid, violently hot, parched
 ze'-ro, the point on the thermometer which
 is marked 0°
 lit'-to-ral, belonging to the shore
 hab'-i-tat, a dwelling

ar-chi-pel'-a-go, a sea abounding in small
 islands
 zone, a girdle, a division of the earth
 trop'-ics, that portion of the earth which
 extends $23\frac{1}{2}$ degrees north and south of
 the equator

MODERN INGENUITY has suggested a beautiful mode of warming houses in winter. It is done by means of hot water. The furnace and the caldron are sometimes placed at a distance from the apartments to be warmed. It is so at the Washington Observatory. In this case, pipes are used to conduct the heated water from the caldron under the superintendent's dwelling over into one of the basement-rooms of the Observatory, a distance of one hundred feet. These pipes are then flared out so as to present a large cooling surface ; after which they are united into one again, through which the water, being now cooled, returns of its own accord to the caldron. Thus

cool water is returning all the time and flowing in at the bottom of the caldron, while hot water is continually flowing out at the top. The ventilation of the Observatory is so arranged that the circulation of the atmosphere through it is led from this basement-room, where the pipes are, to all other parts of the building; and in the process of this circulation, the warmth conveyed by the water to the basement is taken thence by the air and distributed over all the rooms. Now, to compare small things with great, we have, in the warm waters which are contained in the Gulf of Mexico, just such a heating apparatus for Great Britain, the North Atlantic, and Western Europe.

The furnace is the Torrid Zone; the Mexican Gulf and Caribbean Sea are the caldrons; the Gulf Stream is the conducting pipe. From the Grand Banks of Newfoundland to the shores of Europe is the basement—the hot-air chamber—in which this pipe is flared out so as to present a large cooling surface. Here the circulation of the atmosphere is arranged by nature; it is from west to east; consequently it is such that the warmth thus conveyed into this warm-air chamber of mid-ocean is taken up by the genial west winds, and dispensed in the most benign manner throughout Great Britain and the West of Europe. The mean temperature of the water-heated air-chamber of the Observatory is about 90° . The maximum temperature of the Gulf Stream is 86° , or about 9° above the ocean temperature due to the latitude. Increasing its latitude 10° it loses but 2° of temperature; and after having run three thousand miles towards the north, it still preserves, even in winter, the heat of summer. With this temperature it crosses the 40th degree of North latitude, and there, overflowing its liquid banks, it spreads itself out for thousands of square leagues over the cold waters around, covering the ocean with a mantle of warmth that serves so much to mitigate in Europe the rigours of winter. Moving now more slowly, but dispensing its genial influences more freely, it finally meets the British Islands. By these it is divided, one part going into the polar basin of Spitzbergen, the other entering the Bay of Biscay, but each with a warmth considerably above the ocean temperature. Such an immense volume of heated water cannot fail to carry with it beyond the seas a mild and moist atmosphere: and this it is which so much softens the climate there.

We know not, except approximately in a few places, what the depth of the under-temperature of the Gulf Stream may be; but assuming the temperature and velocity at the depth of two hundred fathoms to be those of the surface, and taking the well-known difference between the capacity of air and of water for specific heat as the argument, a simple calculation will show that the quantity of heat discharged over the Atlantic

from the waters of the Gulf Stream in a winter's day would be sufficient to raise the whole column of atmosphere that rests upon France and the British Islands from the freezing-point to summer heat.

Every west wind that blows crosses this stream on its way to Europe, and carries with it a portion of this heat to temper there the northern winds of winter. It is the influence of this stream upon climate that makes Erin 'the Emerald Isle of the Sea,'—that clothes the shores of Albion in evergreen robes, while in the same latitude, on this side, the coasts of Labrador are fast bound in fetters of ice. In a valuable paper on Currents, Mr. Redfield states that in 1831 the harbour of St. John's, Newfoundland, was closed with ice as late as the month of June; yet who ever heard of the port of Liverpool, on the other side, though 2° farther North, being closed with ice, even in the dead of winter?

Scott, in one of his beautiful novels, tells us that the ponds in the Orkneys (latitude near 60°) are not frozen in winter. The people there owe their soft climate to this grand heating apparatus, and to the latent heat of the vapours from it which is liberated during the precipitation of them upon the regions round about. Driftwood from the West Indies is occasionally cast upon the islands of the North Sea and Northern Ocean by the Gulf Stream.

Nor do the beneficial influences of this stream upon climate end here. The West Indian Archipelago is encompassed on one side by its chain of islands, and on the other by the Cordilleras of the Andes, contracting with the Isthmus of Darien, and stretching themselves out over the plains of Central America and Mexico. Beginning on the summit of this range, we leave the regions of perpetual snow, and descend first into the 'tierra templada,' and then into the 'tierra caliente,' or burning land. Descending still lower, we reach both the level and the surface of the Mexican seas, where, were it not for this beautiful and benign system of aqueous circulation, the peculiar features of the surrounding country assure us we should have the hottest if not the most pestilential climate in the world. As the waters in these two caldrons become heated, they are borne off by the Gulf Stream, and are replaced by cooler currents through the Caribbean Sea; the surface-water, as it enters here, being 8° or 4°, and that in depth even 40° cooler than when it escapes from the Gulf. Taking only this difference in surface temperature as an index of the heat accumulated there, a simple calculation will show that the quantity of heat daily carried off by the Gulf Stream from those regions, and discharged over the Atlantic, is sufficient to raise mountains of iron from zero to the melting-point, and to keep in flow from

them a molten stream of metal greater in volume than the waters daily discharged from the Mississippi River.

Who, therefore, can calculate the benign influence of this wonderful current upon the climate of the South? In the pursuit of this subject the mind is led from nature up to the Great Architect of nature; and what mind will not the study of this subject fill with profitable emotions! Unchanged and unchanging, alone of all created things, the ocean is the great emblem of its Everlasting Creator. 'He treadeth upon the waves of the sea, and is seen in the wonders of the deep.' Yea, 'He calleth for the waters of the sea, and poureth them out upon the face of the earth.' In obedience to this call, the aqueous portion of our planet preserves its beautiful system of circulation. By it heat and warmth are dispensed to the extratropical regions; clouds and rain are sent to refresh the dry land; and by it cooling streams are brought from polar seas to temper the heat of the torrid zone. At the depth of two hundred and forty fathoms the temperature of the currents setting into the Caribbean Sea has been found as low as 48° , while that of the surface was 85° . Another cast with three hundred and eighty-six fathoms gave 43° below, against 83° at the surface. The hurricanes of those regions agitate the sea to great depths; that of 1780 tore rocks up from the bottom seven fathoms deep, and cast them ashore. They therefore cannot fail to bring to the surface portions of the cooler water below.

At the very bottom of the Gulf Stream, when its surface temperature was 80° , the deep-sea thermometer of the Coast Survey has recorded a temperature as low as 35° Fahrenheit. These cold waters doubtless come down from the north to replace the warm water sent through the Gulf Stream to moderate the cold of Spitzbergen; for within the Arctic Circle the temperature at corresponding depths off the shores of that island is said to be only one degree colder than in the Caribbean Sea, while on the shores of Labrador and in the polar seas the temperature of the water beneath the ice was invariably found by Lieutenant De Haven at 28° , or 4° below the melting-point of fresh-water ice. Captain Scoresby relates, that on the coast of Greenland, in latitude 72° , the temperature of the air was 42° , of the water 34° , and 29° at the depth of one hundred and eighteen fathoms. He there found a surface current setting to the south, and bearing with it this extremely cold water, with vast numbers of icebergs, whose centres perhaps were far below zero. It would be curious to ascertain the routes of these undercurrents on their way to the tropical regions, which they are intended to cool. One has been found at the equator *two hundred miles broad and 23° colder than the surface-water.* Unless the land or shoals intervene, it no doubt comes down

in a spiral curve, approaching in its course the Great Circle route.

Perhaps the best indication as to these cold currents may be derived from the fish of the sea. The whales, by avoiding its warm waters, pointed out to the fisherman the existence of the Gulf Stream. Along our own coasts, all those delicate animals and marine productions which delight in warmer waters are wanting, thus indicating, by their absence, the prevalence of the cold current from the north now known to exist there. In the genial warmth of the sea about the Bermudas on one hand, and Africa on the other, we find in great abundance those delicate shellfish and coral formations which are altogether wanting in the same latitudes along the shores of South Carolina. The same obtains in the west coast of South America; for there the immense flow of polar waters, known as Humboldt's Current, almost reaches the Line before the first sprig of coral is found to grow. A few years ago great numbers of bonita and albercore (tropical fish), following the Gulf Stream, entered the English Channel, and alarmed the fishermen of Cornwall and Devonshire by the havoc which they created among the pilchards. It may well be questioned if the Atlantic cities and towns of America do not owe their excellent fish-markets, and the watering-places their refreshing sea-bathing in summer, to this littoral stream of cold water. The temperature of the Mediterranean is 4° or 5° above the ocean temperature of the same latitude, and the fish there are, for the most part, very indifferent. On the other hand, the temperature along the American coast is several degrees below that of the ocean, and from Maine to Florida, tables are supplied with the most excellent of fish. The sheep's-head of this cold current, so much esteemed in Virginia and the Carolinas, loses its flavour, and is held in no esteem, when taken on the warm coral-banks of the Bahamas. The same is the case with other fish: when taken in the cold water of that coast they have a delicious flavour, and are highly esteemed; but when taken in the warm water on the other edge of the Gulf Stream, though but a few miles distant, their flesh is soft and unfit for the table. The temperature of the water at the Belize reaches 90° . The fish taken there are not to be compared with those of the same latitude in this cold stream. New Orleans, therefore, resorts to the cool waters on the Florida coasts for her choicest fish. The same is the case in the Pacific. A current of cold water from the south sweeps the shores of Chili, Peru, and Columbia, and reaches the Gallipagos Islands under the equator. Throughout this whole distance the world does not afford a more abundant or excellent supply of fish. Yet out in the Pacific, at the Society Islands, where coral abounds, and the water preserves

a higher temperature, the fish, though they vie in gorgeousness of colouring with the birds and plants and insects of the tropics, are held in no esteem as an article of food. I have known sailors, even after long voyages, still prefer their salt-beef and pork to a mess of fish taken there. The few facts which we have bearing upon this subject seem to suggest it as a point of the enquiry to be made, whether the habitat of certain fish does not indicate the temperature of the water, and whether these cold and warm currents of the ocean do not constitute the great highways through which migratory fishes travel from one region to another? Why should not fish be as much the creatures of climate as plants, or as birds and other animals of land, sea, and air? Indeed, we know that some kinds of fish are found only in certain climates: in other words, they live where the temperature of the water ranges between certain degrees.

MENSURATION.

Flooring, roofing, &c.:—

- (1) How many squares (each 100 square ft.) are there in a close fence round a garden, measuring 325 ft. 9 in. long, and 23 ft. 6 in. wide, its height being 18 ft.?
- (2) What would painting the above cost, at 5s. 7d. per square?
- (3) What will be the cost of slating the roof of a house which is 68 ft. in depth and 40 ft. in width, the rafters of which are 'true pitch' (i.e. each $\frac{3}{4}$ the width of the house), at 9s. 6d. per square?

Plumbers' work:—

- (4) How much lead of 10 lbs. to the square foot will line a rectangular cistern, without a lid, 5 ft. 9 in. long, 4 ft. wide, and 3 ft. 6 in. deep (interior measurement)?
- (5) What will the covering and guttering a roof with lead cost at 18s. per cwt., the length of the roof being 43 ft., and breadth or girth over it 32 ft., the guttering 67 ft. long and 2 ft. wide—supposing the former to be 9½ lbs. and the latter 7½ lbs. to the square foot?

A SKETCH OF THE RISE OF BRITISH POWER IN INDIA.

(From the speech [fourth day] of Mr. Burke on the impeachment of Warren Hastings.)

con-tin'-gent (n.), proportion, chance
 lus-tra'-tion, purification
 prog-nos'-ti-cate, to foretell
 mu-ni'-cip-al, belonging to a corporation
 pre-scrip'-tive, established by custom
 vi'-ti-a-ting, corrupting

te-na'-cions, holding fast
 pec-u-lia'-tion, theft of public money
 im'-mi-nent, threatening, near
 mer'-ce-nar-y, sold for money, hired
 ve'-nal, that may be sold
 su-per-nade', to set aside, to set above

[Mr. Warren Hastings was the first Governor-General of India. He was a man of great genius as a statesman, and greatly extended the power and influence of the English in India; but he was guilty of many acts which were considered unjustifiable by the House of Commons, which ordered his impeachment. The management of this was entrusted to the Right Honourable Edmund Burke, assisted by Sheridan, Fox, and others (1789). His trial lasted until April 17th, 1795, on which day he was acquitted of all the charges by a large majority.]

Until the year 1858 India was governed by the East India Company, which held its authority by a charter from the Crown, the Governor-General being appointed by the Sovereign. After the suppression of the Sepoy revolt (1857-8) the Queen was declared Empress of India, and the rule of the Company was transferred to the Imperial Government.]

MY LORDS, to obtain empire is common: to govern it well has been rare indeed. To chastise the guilt of those who have been instruments of imperial sway over other nations, by the high superintending justice of the sovereign state, has not many striking examples among any people. Hitherto we have not furnished our contingent to the records of honour: we have been confounded with the herd of conquerors. Our dominion has been a vulgar thing. But we begin to emerge; and I hope that a severe inspection of ourselves, a purification of our own offences, a lustration of the exorbitances of our own power, is a glory reserved to this time, to this nation, and to this august tribunal.

The year 1756 is a memorable era in the history of the world: it introduced a new nation from the remotest verge of the Western World, with new manners, new customs, new institutions, new opinions, new laws, into the heart of Asia. My lords, if in that part of Asia whose native regular government was then broken up; if, at the moment when it had fallen into darkness and confusion, from having become the prey and almost the sport of the ambition of its home-born grandees; if, in that gloomy season, a star had risen from the West, that would prognosticate a better generation, and would shed down the sweet influences of order, peace, science, and security to the natives of that vexed and harassed country, we should have been covered with genuine honour—it would have been a beautiful and noble spectacle to mankind.

Indeed, something might have been expected of the kind, when a new dominion emanated from a learned and enlightened part of the world in the most enlightened period of its existence. Still more might it have been expected, when that dominion was found to issue from the bosom of a free country, that it would have carried with it the full benefit of the vital principle of the British liberty and constitution, though its municipal forms were not communicable, or at least the advantage of the liberty and spirit of the British constitution. Had this been the case (alas! it was not), you would have been saved the trouble of this day. It might have been

expected, too, that in that enlightened state of the world, influenced by the best religion, and from an improved description of that best religion—I mean the Christian Reformed religion—that we should have done honour to Europe, to letters, to laws, to religion—done honour to all the circumstances of which in this island we boast ourselves at the great and critical moment of that revolution.

My lords, it has happened otherwise. It is now left for us to repair our former errors. Resuming the history where I broke off yesterday, Surajah Dowla was the adopted grandson of Ally Verdy Cawn, a cruel and ferocious tyrant, the manner of whose acquisition of power I have already stated. He came too young and inexperienced to that throne of usurpation. It was a usurpation yet green in the country, and the country felt uneasy under it. It had not the advantage of that prescriptive usage, that inveterate habit, that traditionary opinion, which a long continuance of any system of government secures to it. The only real security which Surajah Dowla's government could possess, was the security of an army. But the great aim of this prince and his predecessor was to supply the weakness of his government by the strength of his purse; he therefore amassed treasures by all ways and on all hands. But, as the Indian princes in general are as unwisely tenacious of their treasure as they are rapacious in getting it, the more money he amassed the more he felt the effects of poverty. The consequence was that their armies were unpaid, and being unpaid, or irregularly paid, were undisciplined, disorderly, unfaithful. In this situation a young prince, confiding more in the appearances than examining into the reality of things, undertook (from motives which the House of Commons, with all their industry to discover the circumstances, have found it difficult to make out) to attack a little miserable trading-fort that we had erected at Calcutta. He succeeded in that attempt, only because success in that attempt was easy. A close imprisonment of the whole settlement followed—not owing, I believe, to the direct will of the prince, but (what will always happen when the will of the prince is but too much the law) to a gross abuse of his power by his lowest servants; by which one hundred and twenty or more of our countrymen perished miserably in a dungeon by a fate too tragical for me to be desirous to relate, and too well known to stand in need of it.*

* This was the circumstance known as the massacre of the 'Black Hole,' the name given to the dungeon, a close cell not twenty feet square, with scarcely any light or ventilation, in which 146 prisoners were confined without water, for a whole night, in the hottest season. Their sufferings were horrible, and in the morning 126 were taken out dead. Clive, with Admiral Watson, hastened from Madras with a force of 1,000 Europeans and 2,000 Sepoys, and, attacking the army of Surajah Dowlah, consisting of 68,000 men at Plassey, gained a complete victory.—Ed.

At the time that this event happened, there was a concurrence of other events, which, from this partial and momentary weakness, displayed the strength of Great Britain in Asia. For some years before, the French and English troops began, on the coast of Coromandel, to exhibit the power, force, and efficacy of European discipline. As we daily looked for a war with France, our settlements on that coast were in some degree armed. Lord Pigot, then Governor of Madras—Lord Pigot, the preserver, and the victim, of the British dominion in Asia—detached such of the Company's force as could be collected and spared, and such of his Majesty's ships as were on that station, to the assistance of Calcutta. And to hasten this history to its conclusion—the daring and commanding genius of Clive—the patient and firm ability of Watson—the treachery of Meer Jaffier—and the Battle of Plassey, gave us at once the patronage of a kingdom and the command of all its treasures. We negotiated with Meer Jaffier for the viceregal throne of his master. On that throne we seated him. And we obtained, on our part, immense sums of money. We obtained 1,000,000*l.* sterling for the Company—upwards of 1,000,000*l.* for individuals: in the whole, a sum of about 2,230,000*l.*, for various purposes, from the prince whom we had set up. We obtained, too, the town of Calcutta more completely than we had before possessed it, and twenty-four districts adjoining. This was the first small seminal principle of the immense territorial acquisitions we have since made in India.

Many circumstances of this acquisition I pass by. There is a sacred veil to be drawn over the beginnings of all governments. Ours, in India, had an origin like those which time has sanctified by obscurity. Time, in the origin of most governments, has thrown this mysterious veil over them; prudence and discretion make it necessary to throw something of the same drapery over more recent foundations, in which otherwise the fortune, the genius, the talents, and military virtue of this nation never shone more conspicuously. But, whatever necessity might hide, or excuse, or palliate in the acquisition of power, a wise nation, when it has once made a revolution upon its own principles and for its own ends, rests there. The first step to empire is revolution, by which power is conferred; the next is good laws, good orders, good institutions, to give that power stability. I am sorry to say, that the reverse of this policy was the principle upon which the gentlemen in India acted. It was such as tended to make the new government as unstable as the old. By the vast sums of money acquired by individuals upon this occasion, by the immense sudden prodigies of fortune, it was discovered that a revolution in Bengal

was a mine much more easily worked, and infinitely more productive, than the mines of Potosi and Mexico. It was found that the work was not only very lucrative, but not at all difficult. Where Clive forded a deep water upon an unknown bottom, he left a bridge for his successors, over which the lame could hobble, and the blind might grope their way. There was not at that time a knot of clerks in a counting-house, there was not a captain of a band of ragged topasses, that looked for anything less than the deposition of soubahs and the sale of kingdoms. Accordingly, this revolution, which ought to have precluded other revolutions, unfortunately became fruitful of them; and when Lord Clive returned to Europe, to enjoy his fame and fortune in his own country, there arose another description of men, who thought that a revolution might be made upon his revolution, and as lucrative to them as his was to the first projectors. Scarcely was Meer Jaffier, Lord Clive's nabob, seated on his musnud, than they immediately, or in a short time, projected another revolution—a revolution which was to unsettle all the former had settled—a revolution to make way for new disturbances and new wars, and which led to that long chain of peculation which ever since has afflicted and oppressed Bengal.

If ever there was a time when Bengal should have had respite from internal revolutions, it was this. The governor forced upon the natives was now upon the throne. All the great lords of the country, both Gentoos and Mahommedans, were uneasy, discontented, and disobedient; and some absolutely in arms, and refusing to recognise the prince we had set up. An imminent invasion of the Mahrattas—an actual invasion headed by the son of the Mogul—the revenues, on account of the late shock, very ill collected, even where the country was in some apparent quiet—a hungry treasury at Calcutta, an empty treasury at Moorshedabad—everything demanded tranquillity, and with it order and economy. In this situation it was resolved to make a new and entirely mercenary revolution, and to set up to sale the government, secured to its present possessor by every tie of public faith, and every sacred obligation which could bind or influence mankind. This second revolution forms that period in the Bengal history which had the most direct influence upon all the subsequent transactions. It introduces some of the persons who were most active in the succeeding scenes, and from that time to this has given its tone and character to the British affairs and government. It marks and specifies the origin and true principle of all the abuses which Mr. Hastings was afterwards appointed to correct, and which the Commons charge that he continued and aggravated—namely, the venal depositions and venal exaltations of the

country powers; the taking of bribes and corrupt presents from all parties in those changes; the vitiating and maiming the Company's records; the suppression of public correspondence; corrupt combinations and conspiracies; perfidy in negotiation established into principle; acts of the most atrocious wickedness justified upon purity of intention; mock trials and collusive acquittals among the parties in common guilt; and, in the end, the Court of Directors supporting the scandalous breach of their own orders. I shall state the particulars of this second revolution more at large.

Soon after the revolution which had seated Meer Jaffier on the viceregal throne, the spirit of the Mogul Empire began, as it were, to make one faint struggle before it finally expired. The then heir to that throne, escaping from the hands of those who had held his father prisoner, had put himself at the head of several chiefs, collected under the standard of his house, and appeared in force on the frontiers of the provinces of Bengal and Behar, upon both of which he made some impression. This alarmed the new powers, the Nabob Meer Jaffier and the Presidency of Calcutta; and, as in a common cause, and by the terms of their mutual alliance, they took the field against him. The Nabob's eldest son and heir-apparent commanded in chief. Major Calliaud commanded the English forces under the Government of Calcutta. Mr. Holwell was in the temporary possession of the Presidency. Mr. Vansittart was hourly expected to supersede him. Mr. Warren Hastings, a young gentleman about twenty-seven years of age, was Resident for the Company at the durbar (or court) of Meer Jaffier, our new-created Nabob of Bengal, allied to this country by the most solemn treaties that can bind men, for which treaties he had paid, and was then paying, immense sums of money. Mr. Warren Hastings was the pledge in his hands for the honour of the British nation, and their fidelity to their engagements.

In this situation Mr. Holwell, whom the terrible example of the Black Hole at Calcutta had not cured of ambition, thought an hour was not to be lost in accomplishing a revolution, and selling the reigning Nabob.

My lords, there was in the house of Meer Jaffier, in his court, and in his family, a man of an intriguing, crafty, subtle, and at the same time bold, daring, desperate, bloody, and ferocious character, called Cossim Ally Cawn. He was the son-in-law of Meer Jaffier; and he made no other use of this affinity than to find some means to dethrone and to murder him. This was the person in whose school of politics Mr. Hastings made his first studies, and whose conduct he quotes as his example, and for whose friends, agents, and favourites he has always shown a marked predilection. This dangerous man was not long without

finding persons who observed his talents with admiration, and who thought fit to employ him.

MENSURATION.

Painting, plastering, &c. :—

- (1) What will a piece of wainscoting cost which is 9 ft. 6 in. long and 3 ft. 10 in. high, at 6s. 7½d. per square yard?
- (2) What would be the cost of painting the walls of a room which is 11 ft. 6 in. long, 10 ft. 9 in. wide, and 10 ft. 6 in. high, ceiling included, at 2s. 8d. per yard?
- (3) What would be the cost of polishing the outside and inside of a box 7 ft. 4 in. long, 4 ft. 9 in. wide, and 3 ft. 8 in. deep, at 8½d. per yard, lid included?
- (4) What is the cost of papering 6 rooms, each 10 ft. 6 in. by 13 ft. 8 in. and 10 ft. high, allowing for a door in each 3 ft. by 6 ft. 6 in., and a fireplace 3 ft. 6 in. by 3 ft. 9 in., at 2½d. per yard, and colouring the ceilings at 5d. per yard?

THE SEPARATION OF THE AMERICAN COLONIES FROM ENGLAND.

GENERAL WASHINGTON—THE BATTLE OF BUNKER'S HILL, 1775.

(From the 'History of England, from the Peace of Utrecht to the Peace of Versailles, 1713-1783,' by Lord Mahon.)

sa'-li-ent, leaping, standing out with
special significance
chequ'-er-ed, diversified, variegated
con-tem-po'-ra-ry (n.), one who lives at
the same time
re-pu-di-a'-tion, rejection

pro-mul'-gate, to publish, to make known
by public declaration
stren'-u-ous-ly, vigorously, zealously
pro-trad'-tion, the act of drawing out or
lengthening
fla-gri'-tious, wicked, atrocious

[In 1764 it was resolved by the House of Commons to add to the revenue in England by imposing certain duties on foreign goods imported into America. It was also resolved to obtain a direct revenue from the colonists by means of a stamp-tax. The Stamp Act was passed in 1765. The Act created great discontent in America, especially at Boston. In consequence of this, and of the opposition of the elder Pitt and others in the House, the Bill was very soon repealed. In 1767, however, a Bill was passed imposing duties on glass, paper, pasteboard, white and red lead, painters' colours, and tea. This Act created such dissatisfaction that in Boston the people determined on rejecting British importations. This resolution soon became general throughout the colonies; and the war began, which resulted in the Declaration of Independence being promulgated by the Americans, July 4th, 1776. The war continued some time longer, but the independence of America was finally recognised, and a treaty of peace signed with that country, Sept. 3, 1783.]

It has been justly remarked that of General Washington there are fewer anecdotes to tell than perhaps of any other great man on record. So equally framed were the features of his mind, so harmonious all its proportions, that no one quality rose salient above the rest. There were none of those chequered hues, none

of those warring emotions, in which biography delights. There was no contrast of lights and shades, no flickering of the flame; it was a mild light that seldom dazzled, but that ever cheered and warmed. His contemporaries or his close observers, as Mr. Jefferson and Mr. Gallatin, assert that he had naturally strong passions, but had attained complete mastery over them. In self-control indeed he has never been surpassed. If sometimes, on rare occasions and on strong provocation, there was wrung from him a burst of anger, it was almost instantly quelled by the dominion of his will. He decided surely, though he deliberated slowly; nor could any urgency or peril move him from his composure, his calm clear-headed good sense. Integrity and truth were also ever present in his mind. Not a single instance, as I believe, can be found in his whole career, when he was impelled by any but an upright motive, or endeavoured to attain an object by any but worthy means. Such are some of the high qualities which have justly earned for General Washington the admiration even of the country he opposed, and not merely the admiration but the gratitude and affection of his own. Such was the pure and upright spirit to which, when its toils were over and its earthly course had been run, was offered the unanimous homage of the assembled congress, all clad in deep mourning for their common loss, as to 'the man first in war, first in peace, and first in the hearts of his fellow-citizens.' At this day, in the United States, the reverence for his character is, as it should be, deep and universal, and not confined, as with nearly all our English statesmen, to one party, one province, or one creed. Such reverence for Washington is felt even by those who wander farthest from the paths in which he trod. A president when recommending measures of aggression and invasion, can still refer to him whose rule was ever to arm only in self-defence, as to 'the greatest and best of men!' States which exult in their bankruptcy as a proof of their superior shrewdness, and have devised 'Repudiation' as a newer and more graceful term for it, yet look up to their great general—the very soul of good faith and honour—with their reverence unimpaired! Politicians who rejoice in seeing the black man the property and chattel of the white, and desire to rank that state of things amongst their noblest 'Institutions,' are yet willing to forgive or to forget how Washington prayed to God that a spirit to set free the slave might speedily diffuse itself amidst his countrymen! Thus may it be said of this most virtuous man what in days of old was said of Virtue herself, that even those who depart most wildly from her precepts still keep holy and bow down to her name.

It is worthy of note that the officers appointed by the congress to act under Washington with the rank of brigadier or

major-general were not all Americans by birth. Horatio Gates was an Englishman, and the godson of Horace Walpole, having reached the rank of major in the British service. Charles Lee was another Englishman, a correspondent of Burke and Claremont, and holding a royal commission as colonel, which he now resigned. Montgomery, who had likewise served in our ranks, was a native of the north of Ireland.

Throughout the twelve colonies, with only slight exceptions, the decisions of the congress, both as to measures and appointment, were readily adopted and obeyed. In nearly all it may be said that the established royal government fell without a blow. The governors took to flight or sought refuge on board a king's ship, while their partisans found themselves far outnumbered and overmatched, and their place was supplied by committees of safety or by the popular chiefs of each assembly.

The appointment of Washington as general-in-chief took place on June 15. Six days afterwards his Excellency (for thus was he addressed on service) set out to assume the command of the army engaged in the blockade of Boston. But during that interval events of no common importance had there occurred. At the close of May and beginning of June the expected reinforcements from England had arrived. They were headed by General Burgoyne, General William Howe, the brother of Lord Howe, and General Henry Clinton, officers who, as will be seen hereafter, bore a principal part in the subsequent transactions of the war. By this accession the whole force under General Gage as commander-in-chief was raised to nearly ten thousand men. With these troops—which were courageous and well-disciplined, and which should have been well commanded—an attack might have been made with every prospect of complete success against the bodies of American militia, superior in mere numbers, but extended along a line of ten miles, not being as yet inured to arms, and not having among them any general in whom they felt entire confidence. Either conciliation or else conquest should have been strenuously pursued. But it was the bane of England, not merely on this occasion, but throughout the whole early part of this war, to have for chiefs men brave indeed and honourable, skilled in the details of the service, and zealous for Old England and King George, but in genius fitted only for a second place, not gifted by Nature with that energy and firmness essential for a chief command. Take, for instance, the career of Burgoyne. He was an illegitimate son of Lord Bingley, and had raised his fortune by a runaway match with a daughter of the Earl of Derby. In Portugal he had served with much distinction; at Preston he had been a candidate, at the expense, it was said, of no less than ten thousand pounds. In war his bravery was never ques-

tioned, and in civil life he was gifted with many high accomplishments; a fluent speaker in Parliament, and an agreeable writer of plays. His comedy, 'The Heiress,' is still acted with applause. But judging by the event at least, we might be tempted to apply to him those humorous words, which another playwright—no less a one than Lope de Vega—describes himself during his own days of soldiery, as a man who in his youth had done nothing, and who since his youth had done less. Of the other chiefs some might be superior to Burgoyne, but all were far from equal to Olive; and in an evil hour for the military fame of England, though happily perhaps as sparing the protraction of an inevitable issue, Lord Olive had fallen by his own hand only six months before. There was wanting in the Cabinet that energy which enables a Prime Minister to discard the rules of seniority in the selection of a general. There was wanting, in short, a master-mind, like Chatham's, to discover and call forth a master-mind like Wolfe's.

On the arrival of his reinforcements General Gage issued a proclamation declaring martial law to be in force, but offering a free pardon to all who would lay down their arms, excepting John Hancock and Samuel Adams, whose offences were described as too flagitious to be thus forgiven. No result of any kind attended the publication of this manifesto, except perhaps an increase of enterprise on the part of the Americans. Opposite to Boston stands the small town, or rather, perhaps, the suburb, of Charlestown, severed from the capital by one arm of the sea, which for breadth has been compared to the Thames at London Bridge. Charlestown, like Boston itself, is built at the extremity of a peninsula, which is joined to the continent by a neck or narrow strip of land. Within this peninsula of Charlestown, the ground rises in two uneven ridges; the one nearest to Boston called Breed's Hill; the other, more remote, Bunker's Hill. Important as this position appeared to the security of Boston, it had hitherto been neglected by General Gage. The Americans, more alert, now resolved to occupy it. On the evening of June 16, they sent a body of their militia along Charlestown Neck, with directions to intrench themselves on Bunker's Hill. The troops marched accordingly, but by some mistake as to their orders they, instead of Bunker's, took possession of Breed's Hill. Working all night, they threw up a square redoubt on the summit of the ground; working so secretly, however, as not to give the least alarm to several ships of war that were anchored at no great distance from them. When on the morning of the 17th, the break of day discovered their position, a heavy cannonade was opened upon them from the 'Lively' sloop, and from Copp's Hill in Boston; but this

the Americans sustained very calmly, and in spite of it completed their intrenchments.

As the position of Breed's Hill overlooked the town of Boston, General Gage thought it necessary to drive the Americans from it. With this view he sent over in boats a division of his army, commanded by General Howe. The troops landed towards noon, but perceiving the Americans wait for them with firmness, General Howe applied for a reinforcement, which was dispatched accordingly, and which raised his whole numbers to above two thousand men. During this interval the Americans also received from their main army a large accession of force, led on by Dr. Joseph Warren, the physician of Boston, who had lately become the president of the Massachusetts Congress, and been raised (by his own authority in fact) to the rank of major-general. Then all preparations being completed, the British troops slowly advanced up the hill, formed in two lines, and under cover of a heavy fire of cannon and howitzers. Their right was headed by General Howe; their left by Brigadier-General Pigot. As the left marched forward it was greatly galled in flank by musketry from Charlestown, a body of American riflemen having been posted in the houses; upon which, by Howe's order, the town was set on fire and destroyed; an act afterwards urged against the English, though surely without good reason, as a wanton and barbarous outrage. Over these painful scenes of civil strife and desolation was poured the unclouded effulgence of a mid-day and midsummer sun. General Burgoyne, who was gazing upon them from one of the batteries at Boston, has described them in a private letter with no slight dramatic force. 'And now,' says he, 'ensued one of the greatest scenes of war that can be conceived. If we look to the height, Howe's corps ascending the hill in the face of intrenchments and in a very disadvantageous ground, was much engaged; to the left the enemy pouring in fresh troops by thousands over the land, and in the arm of the sea our ships and floating batteries cannonading them; straight before us a large and noble town in one great blaze; and the church-steeple, being timber, were great pyramids of fire above the rest—behind us the church-steeple and heights of our own camp, covered with spectators of the rest of our army which was engaged; the hills round the country also covered with spectators, the enemy all in anxious suspense, the roar of cannon, mortars, and musketry; the crash of churches, ships upon the stocks, and whole streets falling together to fill the ear; the storm of the redoubts with the objects above described to fill the eye; and the reflection that perhaps a defeat was a *final loss* to the British empire in America to fill the mind; *made the whole a picture and a complication of horror and im-*

portance beyond anything that ever came to my lot to witness.' When the English approached the summit of Breed's Hill the Americans encountered them with great coolness and determination, reserving their fire till within eighty or a hundred yards, and then pouring it with deadly aim. Then were blown to the winds the silly predictions of Lord Sandwich and Colonel Grant as to the alleged deficiency of courage in the colonists; predictions which, besides being in this case utterly false and groundless, have always a manifest tendency to defeat themselves. Such predictions, it is plain, had not been forgotten by those whose honour they assailed. It is said, that when one of the English regiments drew nearer than the rest, many of the Americans opposite called out to its commanding officer, 'Colonel Abercrombie, are the Yankees cowards?' and most clearly they were not. On the other hand, the British troops had grievous odds against them. By the unskilful directions of their chiefs they were encumbered with three days' provision, and their knapsacks on their backs. Under this heavy load and beneath a burning sun, they had toiled up a rugged hill covered with long grass reaching to their knees, and intersected by various fences and inclosures; and instead of being brought to attack the American force in flank, which would have been equally effectual for dislodging it, they had been led on directly in front, where the ascent was steepest and where the intrenchment was strongest. With these previous disadvantages, and now exposed to the close and well-directed fire of their enemy, they wavered, gave way, and fell back in disorder towards the landing-place. Here they were quickly rallied by their officers, and a second time led up to the charge. But by another blunder of those placed in authority over them, a supply of ball for the field-artillery, being sent from the ordnance department at Boston, was found to be of larger dimension than fitted the calibre of their guns, and this oversight of course prevented the further use of the field-artillery that day. Again did the Americans from behind their intrenchments pour upon them a destructive fire. Again were they repulsed and driven in confusion down the hill. At this critical moment General Clinton, without waiting for orders, put himself at the head of a small detachment (two battalions) which hastened over in boats from Boston. The reinforcement though small was most seasonable, and the presence of Clinton himself proved of material service in rallying the soldiers, and preparing them for another onset. To that onset, the third and last, weary as they were, they rushed up with irresistible impetuosity, carrying the enemy's redoubts at the point of the bayonet. By this time the American's supply of powder had begun to fail; still they fought on bravely, and even, it is said, maintained the contest

with their clubbed muskets, until at last they were dialodged and put to flight. Though retreating in utter disarray, there was no more than a show of pursuit against them; but they suffered severely in passing Charlestown Neck from the cross-fire of two floating batteries and of the 'Glasgow' man-of-war. And thus, only changing the numbers but retaining the phrase of a gallant officer in relating another gallant exploit, we may say that 'the remnant of five and twenty hundred unconquerable British soldiers stood triumphant on the fatal hill!'

Such was the battle which, not quite aptly, considering the disposition of the ground, has received from the neighbouring height the name of Bunker's Hill. The loss of the British was immense, considering the number engaged. Of that number well-nigh half had fallen; above 220 killed, above 820 wounded. The Americans, as having fought behind intrenchments suffered far less severely: according to their own account the entire loss in killed and wounded was under 450. None among their slain was more lamented than their Doctor-General Warren, a man in the prime of life, of tried energy, great powers of persuasion, and highly promising abilities.

The Americans at that period—and some of them even to the present day—have claimed the battle of Bunker's Hill as a victory. Yet, considering that the British were left in possession of the ground and maintained it for several months to come, and considering also that of six pieces of artillery which the Americans brought into action they carried away but one, there can surely be no question that, according to the rules of war, they must be considered as defeated. It may be acknowledged, however, that none of the more substantial fruits of success were on this occasion gathered by the English. The peninsula of Charlestown proved but a barren acquisition to them, since it was comprised in the blockade of Boston by the enemy's lines. And General Washington, arriving at headquarters about a fortnight afterwards, and assuming the chief command, immediately applied himself to strengthen and support those lines by throwing up new intrenchments, stationing new outposts, and adopting every other precaution, so far as his means allowed, to hem in the British troops and prevent them from issuing forth as invaders of the open country.

MENSURATION.

Flooring, &c. :—

- (1) How many squares (each 100 sq. ft.) are there in the floor of a hall measuring 85 ft. by 36 ft.?
- (2) What would be the cost of the above at 15s. 6d. per square?
- (3) What must be paid for roofing a house 70 ft. by 40 ft. at 10s. 8d. per square?

A SKETCH OF MODERN ASTRONOMY.

(From 'A Series of Discourses on Christian Revelation, viewed in Connection with Modern Astronomy,' by Dr. Chalmers.)

di-min'-u-tive, *small*
 plan'-et, *a heavenly body revolving round*
the sun as a centre
 vi-cis'-si-tude, *a change*
 im'-po-tence, *weakness*
 al-le'-vi-ate, *to ease, to soften*
 re-spi-ra'-tion, *the act of breathing*
 pre-ci'-pi-ta-ted, *thrown down*
 an-al'-o-gy, *resemblance*

me-trop'-o-lis, *the chief city of a country*
 top'-i-cal, *local, relating to particular*
places
 con'-cave (n.), *a regular cavity*
 an-ni-hi-la'-tion, *the act of destroying*
 in-nu'-me-ra-ble, *not to be numbered*
 im-meas'-u-ra-ble, *not to be measured*
 ve-lo'-ci-ty, *speed, swiftness of motion*
 in-fal'-li-ble, *incapable of mistake*

We all know that every visible object appears less in magnitude as it recedes from the eye. The lofty vessel, as it retires from the coast, shrinks into littleness, and at last appears in the form of a small speck on the verge of the horizon. The eagle, with its expanded wings, is a noble object; but when it takes its flight into the upper regions of the air, it becomes less to the eye, and is seen like a dark spot upon the vault of heaven. The same is true of all magnitude. The heavenly bodies appear small to the eye of an inhabitant of this earth, only from the immensity of their distance. When we talk of hundreds of millions of miles, it is not to be listened to as incredible: for remember, we are talking of those bodies which are scattered over the immensity of space, and that space knows no termination. The conception is great and difficult, but the truth is unquestionable. By a process of measurement which it is unnecessary at present to explain, we have ascertained first the distance, and then the magnitude of some of those bodies which roll in the firmament; that the sun, which presents itself to the eye under so diminutive a form, is really a globe, exceeding, by many thousands of times, the dimensions of the earth which we inhabit; that the moon itself has the magnitude of a world; and that even a few of those stars, which appear like so many lucid points to the unassisted eye of the observer, expand into large circles upon the application of the telescope, and are some of them much larger than the ball which we tread upon, and to which we proudly apply the denomination of the universe.

Now, what is the fair and obvious presumption? The world in which we live is a round ball of a determined magnitude, and occupies its own place in the firmament. But when we explore the unlimited tracts of that space which is everywhere around us, we meet with other balls of equal or superior magnitude; and from which our earth would either be invisible, or appear as small as any of those twinkling stars which are seen on the canopy of heaven. Why then suppose that this little

spot, little at least in the immensity which surrounds it, should be the exclusive abode of life and intelligence? What reason to think that those mightier globes which roll in other parts of creation, and which we have discovered to be worlds in magnitude, are not also worlds in use and in dignity? Why should we think that the great Architect of Nature, supreme in wisdom as He is in power, would call these stately mansions into existence, and leave them unoccupied? When we cast our eye over the broad sea, and look at the country on the other side, we see nothing but the blue land stretching obscurely over the distant horizon. We are too far away to perceive the richness of its scenery, or to hear the sound of its population. Why not extend this principle to the still more distant parts of the universe? What though, from this remote point of observation, we can see nothing but the naked roundness of yon planetary orbs? Are we therefore to say, that they are so many vast and unpeopled solitudes; that desolation reigns in every part of the universe but ours; that the whole energy of the divine attributes is expended on one insignificant corner of these mighty works; and that to this earth alone belongs the bloom of vegetation, or the blessedness of life, or the dignity of rational and immortal existence? But this is not all. We have something more than the mere magnitude of the planets to allege, in favour of the idea that they are inhabited. We know that this earth turns round upon itself; and we observe that all those celestial bodies which are accessible to such an observation have the same movement. We know that the earth performs a yearly revolution round the sun; and we can detect in all the planets which compose our system a revolution of the same kind, and under the same circumstances. They have the same succession of day and night. They have the same agreeable vicissitude of the seasons. To them, light and darkness succeed each other; and the gaiety of summer is followed by the dreariness of winter. To each of them the heavens present as varied and magnificent a spectacle; and this earth, the encompassing of which would require the labour of years from one of its puny inhabitants, is but one of the lesser lights which sparkle in their firmament. To them, as well as to us, has God divided the light from the darkness, and he has called the light day, and the darkness he has called night. He has said, let there be lights in the firmament of their heaven, to divide the day from the night; and let them be for signs, and for seasons, and for days, and for years; and let them be for lights in the firmament of heaven to give light upon their earth; and it was so. And God has also made to them great lights. To all of them He has given the sun to rule the day; and to many of them has He given moons to rule the night. To

them He has made the stars also. And God has set them in the firmament of heaven, to give light upon their earth; and to rule over the day, and over the night, and to divide the light from the darkness; and God has seen that it was good.

In all these greater arrangements of divine wisdom, we can see that God has done the same things for the accommodation of the planets that He has done for the earth which we inhabit. And shall we say that the resemblance stops here, because we are not in a situation to observe it? Shall we say that this scene of magnificence has been called into being merely for the amusement of a few astronomers? Shall we measure the counsels of heaven by the narrow impotence of the human faculties? or conceive that silence and solitude reign throughout the mighty empire of nature; that the greater part of creation is an empty parade; and that not a worshipper of the Divinity is to be found through the wide extent of yon vast and immeasurable regions?

It lends a delightful confirmation to the argument, when, from the growing perfection of our instruments, we can discover a new point of resemblance between our earth and the other bodies of the planetary system. It is now ascertained, not merely that all of them have their day and night, and that all of them have their vicissitudes of seasons, and that some of them have their moons to rule their night, and alleviate the darkness of it. We can see of one, that its surface rises into inequalities, that it swells into mountains and stretches into valleys; of another, that it is surrounded by an atmosphere which may support the respiration of animals; of a third, that clouds are formed and suspended over it, which may minister to it all the bloom and luxuriance of vegetation; and of a fourth, that a white colour spreads over its northern regions, as its winter advances, and that on the approach of summer this whiteness is dissipated—giving room to suppose that the element of water abounds in it, that it rises by evaporation into its atmosphere, that it freezes on the application of cold, that it is precipitated in the form of snow, that it covers the ground with a fleecy mantle, which melts away from the heat of a more vertical sun; and that other worlds bear a resemblance to our own, in the same yearly round of beneficent and interesting changes.

Who shall assign a limit to the discoveries of future ages? Who can prescribe to science her boundaries, or restrain the active and insatiable curiosity of man within the circle of his present acquisitions? We may guess with plausibility what we cannot anticipate with confidence. The day may yet be coming when our instruments of observation shall be inconceivably more powerful. They may ascertain still more decisive

points of resemblance. They may resolve the same question by the evidence of sense, which is now so abundantly convincing by the evidence of analogy. They may lay open to us the unquestionable vestiges of art, and industry, and intelligence. We may see summer throwing its green mantle over these mighty tracks, and we may see them left naked and colourless after the flush of vegetation has disappeared. In the progress of years or of centuries, we may trace the hand of cultivation spreading a new aspect over some portion of a planetary surface. Perhaps some large city, the metropolis of a mighty empire, may expand into a visible spot by the powers of some future telescope. Perhaps the glass of some observer, in a distant age, may enable him to construct the map of another world, and to lay down the surface of it in all its minute and topical varieties. But there is no end of conjecture, and to the men of other times we leave the full assurance of what we can assert with the highest probability, that yon planetary orbs are so many worlds, that they teem with life, and that the mighty Being who presides in high authority over this scene of grandeur and astonishment has there planted the worshippers of His glory.

Did the discoveries of science stop here, we have enough to justify the exclamation of the Psalmist, 'What is man that thou art mindful of him, or the son of man that thou shouldest deign to visit him?' They widen the empire of creation far beyond the limits which were formerly assigned to it. They give us to see that yon sun, throned in the centre of his planetary system, gives light and warmth, and the vicissitudes of seasons, to an extent of surface several hundreds of times greater than that of the earth which we inhabit. They lay open to us a number of worlds, rolling in their respective circles round that vast luminary, and prove that the ball which we tread upon, with all its mighty burden of oceans and continents, instead of being distinguished from the others, is among the least of them; and, from some of the more distant planets, would not occupy a visible point in the concave of their firmament. They let us know, that though this mighty earth, with all its myriads of people, were to sink into annihilation, there are some other worlds where an event so awful to us would be unnoticed and unknown, and others where it would be nothing more than the disappearance of a little star which had ceased from its twinkling. We should feel a sentiment of modesty at this humiliating but just representation. We should learn not to look on our earth as the universe of God, but as one paltry and insignificant portion of it; that it is only one of the many mansions which the Supreme Being has created for the accommodation of His worshippers, and only one

of the many worlds rolling in that flood of light which the sun pours around him to the outer limits of the planetary system.

But is there nothing beyond these limits? The planetary system has its boundary, but space has none; and if we wing our fancy there, do we travel through dark and unoccupied regions? There are only five, or at most six, of the planetary orbs visible to the naked eye. What, then, is that multitude of other lights which sparkle in our firmament, and fill the whole concave of heaven with innumerable splendours? The planets are all attached to the sun; and, in circling around him, they do homage to that influence which blinds them to perpetual attendance on this great luminary. But the other stars do not own his dominion. They do not circle around him. To all common observation, they remain immovable; and each, like the independent sovereign of his own territory, appears to occupy the same inflexible position in the regions of immensity. What can we make of them? Shall we take our adventurous flight to explore those dark and untravelled dominions? What mean these innumerable fires lighted up in distant parts of the universe? Are they only made to shed a feeble glimmering over this little spot in the kingdom of nature? Or do they serve a purpose worthier of themselves—to light up other worlds, and give animation to other systems?

The first thing which strikes a scientific observer of the fixed stars, is their immeasurable distance. If the whole planetary system were lighted up into a globe of fire, it would exceed, by many millions of times, the magnitude of this world, and yet only appear a small lucid point from the nearest of them. If a body were projected from the sun with the velocity of a cannon-ball, it would take hundreds of thousands of years before it described that mighty interval which separates the nearest of the fixed stars from our sun and from our system. If this earth, which moves at more than the inconceivable velocity of a million and a half miles a day, were to be hurried from its orbit, and to take the same rapid flight over this immense track, it would not have arrived at the termination of its journey, after taking all the time that has elapsed since the creation of the world. These are great numbers, and great calculations, and the mind feels its own impotency in attempting to grasp them. We can state them in words. We can exhibit them in figures. We can demonstrate them by the powers of a most rigid and infallible geometry. But no human fancy can summon up a lively or an adequate conception—can roam in its ideal flight over this immeasurable largeness—can take in this mighty space in all its grandeur, and in all its immensity—can sweep the outer boundaries of such a creation, or lift itself up

to the majesty of that great and invisible Arm on which all is suspended.

MENSURATION.

Masons' work (solid):—

- (1) What is the value of a marble slab, 12 ft. long, 10 ft. wide, and 1 ft. 2 in. thick, at 13s. 9d. per solid foot?
- (2) How many 3-in. cubes could be cut out of a block of marble 3 ft. each way, and what would be the value of each at 15s. per cubic foot?
- (3) What is the value of a stack of timber which measures regularly 86 ft. 10 in. long, 17 ft. 6 in. wide, and 20 ft. high, at 2s. 7½d. per solid foot?
- (4) What is the solid content of a wall which is 60 ft. long, 10 ft. high, and 2½ ft. thick?
- (5) What quantity of stone is contained in a staircase of 32 steps, each step being 2 ft. 10 in. long, 1 ft. 2 in. wide, and 8½ in. thick?

ADVENTURES OF GULLIVER IN BROBDINGNAG.

(From 'Gulliver's Travels,' by Dean Swift.)

[Jonathan Swift, Dean of St. Patrick's, Dublin, was born in that city in 1667. His chief works, 'The Tale of a Tub' and 'Gulliver's Travels,' are political satires. He wrote also various poems, and contributed to the 'Tatler' and the 'Spectator.' He died insane in 1745.]

prov-o-ca'-tion, *cause of anger*
 di-ver't, *to amuse*
 lee-side, *the side which is sheltered from the wind*
 rep'-ri-mand, *to scold*
 rep-u-ta'-tion, *good name, character*
 hang'-er, *a short sword*
 es-pa'-li-er, *a tree trained on a frame or stake*
 mel'-an-chol-y, *sad*
 wher'-ry, *a light river-boat*

di-ver'-sion, *amusement*
 a-gil'-i-ty, *nimbleness*
 star'-board, *the right-hand side of a ship looking towards the head*
 lar'-board, *opposite the starboard*
 in-fal'-li-bly, *without fail*
 stom'-a-cher, *an ornamental covering for the breast, worn by women*
 en-com'-pas-sed, *surrounded*
 ral'-ly, *to 'chaff,' to poke fun at one*

[Having left the Lilliputians, with a number of cows and sheep, in his coat pockets, Gulliver returns to England. After a short time he resumes his travels and comes to the kingdom of Brobdingnag, the natives of which he describes as about ninety feet high. Here he is taken in charge by a young lady of the Court, who has two boxes made in which to keep him and carry him about.]

I SHOULD have lived happy enough in that country, if my littleness had not exposed me to several ridiculous and troublesome accidents, some of which I shall venture to relate. Glumdalclitch often carried me into the gardens of the court in my smaller box, and would sometimes take me out of it, and hold me in her hand, or set me down to walk. I remember, before the dwarf left the Queen, he followed us one day into those gardens, and my nurse having set me down, he and I

being close together, near some dwarf apple-trees, I must needs show my wit by a silly allusion between him and the trees, which happens to hold in their language as it doth in ours. Whereupon, the malicious rogue, watching his opportunity, when I was walking under one of them, shook it directly over my head, by which a dozen apples, each of them near as large as a Bristol barrel, came tumbling about my ears; one of them hit me on the back as I chanced to stoop, and knocked me down flat on my face; but I received no other hurt, and the dwarf was pardoned at my desire, because I had given the provocation.

Another day, Glumdalclitch left me on a smooth grass-plot to divert myself, while she walked at some distance with her governess. In the meantime, there suddenly fell such a violent shower of hail, that I was immediately by the force of it struck to the ground; and when I was down, the hailstones gave me such cruel bangs all over the body, as if I had been pelted with tennis balls; however, I made a shift to creep on all fours, and shelter myself by lying flat on my face, on the lee-side of a border of lemon thyme, but so bruised from head to foot, that I could not go abroad for ten days. Neither is this at all to be wondered at, because nature, in that country, observing the same proportion through all her operations, a hailstone is near eighteen hundred times as large as one in Europe, which I can assert upon experience, having been so curious as to weigh and measure them.

But a more dangerous accident happened to me in the same garden, where my little nurse, believing that she had put me in a secure place, which I often entreated her to do, that I might enjoy my own thoughts, and having left my box at home to avoid the trouble of carrying it, went to another part of the garden with her governess and some ladies of her acquaintance. While she was absent, and out of hearing, a small white spaniel belonging to one of the chief gardeners, having got by accident into the garden, happened to range near the place where I lay; the dog, following the scent, came directly up, and taking me in his mouth ran straight to his master, wagging his tail, and set me gently on the ground. By good fortune he had been so well taught, that I was carried between his teeth without the least hurt, or even tearing my clothes. But the poor gardener, who knew me well, and had a great kindness for me, was in a terrible fright: he gently took me up in both his hands, and asked me how I did; but I was so amazed and out of breath that I could not speak a word. In a few minutes I came to myself, and he carried me safe to my little nurse, who by this time had returned to the place where she left me, and was in cruel agonies when I did.

not appear, nor answer when she called. She severely reprimanded the gardener on account of his dog. But the thing was hushed up, and never known at court; for the girl was afraid of the queen's anger, and truly, as to myself, I thought it would not be for my reputation that such a story should go about.

This accident absolutely determined Glumdalclitch never to trust me abroad for the future out of her sight. I had been long afraid of this resolution, and therefore concealed from her some little unlucky adventures that happened in those times when I was left by myself. Once a kite, hovering over the garden, made a stoop at me, and if I had not resolutely drawn my hanger, and run under a thick espalier, he would have certainly carried me away in his talons. Another time, walking to the top of a fresh mole-hill, I fell to my neck in the hole through which that animal had cast up the earth, and coined some lie, not worth remembering, to excuse myself for spoiling my clothes.

I cannot tell whether I were more pleased or mortified to observe in those solitary walks that the smaller birds did not appear to be at all afraid of me, but would hop about me, within a yard's distance, looking for worms and other food with as much indifference and security as if no creature at all were near them. I remember a thrush had the confidence to snatch out of my hand, with his bill, a piece of cake that Glumdalclitch had just given me for my breakfast. When I attempted to catch any of these birds, they would boldly turn against me, endeavouring to peck my fingers, which I durst not venture within their reach; and then they would hop back unconcerned to hunt for worms or snails, as they did before. But one day I took a thick cudgel, and threw it with all my strength so luckily at a linnet, that I knocked him down, and, seizing him by the neck with both my hands, ran with him in triumph to my nurse. However, the bird, who had only been stunned, recovering himself, gave me so many boxes with his wings on both sides of my head and body, though I held him at arms' length, and was out of the reach of his claws, that I was twenty times thinking to let him go. But I was soon relieved by one of our servants, who wrung off the bird's neck, and I had him next day for dinner by the queen's command. This linnet, as near as I can remember, seemed to be somewhat larger than an English swan.

The queen, who often used to hear me talk of my sea-voyages, and took all occasions to divert me when I was melancholy, asked me whether I understood how to handle a sail or an oar, and whether a little exercise of rowing might not be convenient for my health. I answered that I understood both

very well; for although my proper employment had been to be surgeon or doctor to the ship, yet often upon a pinch I was forced to work like a common mariner. But I could not see how this could be done in their country, where the smallest wherry was equal to a first-rate man-of-war among us, and such a boat as I could manage would never live in any of their rivers. Her Majesty said if I would contrive a boat, her own joiner should make it, and she would provide a place for me to sail in. The fellow was an ingenious workman, and, by my instructions, in ten days finished a pleasure-boat, with all its tackling, able conveniently to hold about eight Europeans. When it was finished, the queen was so delighted that she ran with it in her lap to the king, who ordered it to be put in a cistern full of water with me in it by way of trial, where I could not manage my two sculls, or little oars, for want of room. But the queen had before contrived another project. She ordered the joiner to make a wooden trough of three hundred feet long, fifty broad, and eight deep, which, being well pitched to prevent leaking, was placed on the floor along the wall in an outer room of the palace. It had a cock near the bottom to let out the water when it began to grow stale; and two servants could easily fill it in half an hour. Here I often used to row for my own diversion, as well as that of the queen and her ladies, who thought themselves well entertained with my skill and agility. Sometimes I would put up my sail, and then my business was only to steer, while the ladies gave me a gale with their fans; and, when they were weary, some of the pages would blow my sail forward with their breath, while I showed my art by steering starboard or larboard as I pleased. When I had done, Glumdalclitch always carried back my boat into her closet, and hung it on a nail to dry.

In this exercise I once met an accident, which had like to have cost me my life; for one of the pages, having put my boat into the trough, the governess who attended Glumdalclitch very officiously lifted me up to place me into the boat, but I happened to slip through her fingers, and should infallibly have fallen down forty feet upon the floor, if, by the luckiest chance in the world, I had not been stopped by a corking-pin that stuck in the good gentlewoman's stomach. The head of the pin passed between my shirt and the waistband of my breeches, and thus I was held by the middle in the air, till Glumdalclitch ran to my relief.

Another time, one of the servants whose office it was to fill my trough every third day with fresh-water, was so careless as to let a huge frog (not perceiving it) slip out of his pail. The frog lay concealed till I was put into my boat, but then, seeing a resting-place, climbed up, and made it lean so much on one

side, that I was forced to balance it with all my weight on the other to prevent it overturning. When the frog was got in, it hopped at once half the length of the boat, and then over my head, backwards and forwards, daubing my face and clothes with its odious slime. The largeness of its features made it appear the most deformed animal that can be conceived. However, I desired Glumdalclitch to let me deal with it alone. I banged it a good while with one of my skulls, and at last forced it to leap out of the boat.

But the greatest danger I ever underwent in that kingdom was from a monkey, who belonged to one of the clerks of the kitchen. Glumdalclitch had locked me up in her closet while she went somewhere upon business, or a visit. The weather being very warm, the closet window was left open, as well as the windows and door of my bigger box, in which I usually lived, because of its largeness and conveniency. As I sat quietly meditating at my table, I heard something bounce in at the closet-window, and skip about from one side to the other; whereat, although I was much alarmed, yet I ventured to look out, but not stirring from my seat, and then I saw this frolicsome animal frisking and leaping up and down, till at last he came to my box, which he seemed to view with great pleasure and curiosity, peeping in at the door and every window. I retreated to the farther corner of my room, or box, but the monkey, looking in at every side, put me into such a fright, that I wanted presence of mind to conceal myself under the bed, as I might easily have done. After some time spent in peeping, grinning, and chattering, he at last espied me, and reaching one of his paws in at the door, as a cat does when she plays with a mouse, although I often shifted place to avoid him, he at length seized the lappet of my coat (which, being made of that country's silk, was very thick and strong), and dragged me out. He took me up in his right fore-foot, and held me as a nurse does a child she is going to suckle, just as I have seen the same sort of creature do with a kitten in Europe; and when I offered to struggle he squeezed me so hard, that I thought it more prudent to submit. I have good reason to believe that he took me for a young one of his own species, by his often stroking my face very gently with his other paw. In these diversions he was interrupted by a noise at the closet-door, as if somebody were opening it; whereupon he suddenly leaped up to the window at which he had come in, and thence upon the leads and gutters, walking upon three legs, and holding me in the fourth, till he clambered up to a roof that was next to ours. I heard Glumdalclitch give a shriek at the moment he was carrying me out. The poor girl was almost distracted; that quarter of the palace was all in an uproar; the servants

ran for ladders; the monkey was seen by hundreds in the court, sitting upon the ridge of a building, holding me like a baby in one of his fore-paws, and feeding me with the other, by cramming into my mouth some victuals he had squeezed out of the bag on one side of his chaps, and patting me when I would not eat; whereat many of the rabble below could not forbear laughing. Neither do I think they justly ought to be blamed, for without question the sight was ridiculous enough to everybody but myself. Some of the people threw up stones, hoping to drive the monkey down; but this was strictly forbidden, or else very probably my brains had been dashed out.

The ladders were now applied, and mounted by several men, which the monkey observing, and finding himself almost encompassed, not being able to make speed enough with his three legs, let me drop on a ridge tile, and made his escape. Here I sat for some time, five hundred yards from the ground, expecting every moment to be blown down by the wind, or to fall by my own giddiness, and come tumbling over and over from the ridge to the eaves; but an honest lad, one of my nurse's footmen, climbed up, and putting me into his breeches pocket, brought me down safe.

I was almost choked with the filthy stuff the monster had crammed down my throat; but my dear little nurse picked it out of my mouth with a small needle, when I fell a-vomiting, which gave me great relief. Yet I was so weak and bruised in the sides with the squeezes given me by this odious animal, that I was forced to keep my bed a fortnight. The king, queen, and all the court, sent every day to inquire after my health, and her Majesty made me several visits during my sickness. The monkey was killed, and an order made that no such animal should be kept about the palace.

When I attended the king after my recovery, to return him thanks for his favours, he was pleased to rally me a good deal upon this adventure. He asked me what my thoughts and speculations were while I lay in the monkey's paw; how I liked the victuals he gave me; his manner of feeding; and whether the fresh air on the roof had sharpened my stomach. He desired to know what I would have done upon such an occasion in my own country. I told his Majesty that in Europe we had no monkeys, except such as were brought for curiosities from other places, and so small that I could deal with a dozen of them together if they presumed to attack me. And as for that monstrous animal with whom I was so lately engaged (it was indeed as large as an elephant), if my fears had suffered me to think so far as to make use of my hanger (looking fiercely, and clapping my hand upon the hilt as I spoke) when he poked his paw into my chamber, perhaps I would have

given him such a wound as would have made him glad to withdraw it with more haste than he put it in. This I delivered in a firm tone, like a person who was jealous lest his courage should be called in question. However, my speech produced nothing else besides loud laughter, which all the respect due to his Majesty from those about him could not make them contain. This made me reflect how vain an attempt it is for a man to endeavour to do himself honour among those who are out of all degree of equality or comparison with him. And yet I have seen the moral of my own behaviour very frequent in England since my return, where a little contemptible varlet, without the least title to birth, person, wit, or common sense, shall presume to look with importance, and put himself upon a footing with the greatest persons of the kingdom.

MENSURATION.

Glazing, and Masons' flat work :—

- (1) What is the worth of 27 squares of glass, each 4 ft. 6 in. by 3 ft. 10 in., at 6d. per foot?
- (2) What will be the cost of glazing 24 window sashes, each containing 12 squares 1 ft. 8 in. by 1 ft. 1 in., at 1s. 2½d. per square foot?
- (3) There is a house of four floors. Basement floor has one window, front, ditto back; ground floor, ditto, ditto; first floor, two front, one back; second floor, ditto, ditto. There are also two staircase windows at back. The basement windows are each 3 ft. 6 in. high; ground floor, 5 ft. 3 in.; first floor, 6 ft. 6 in.; second floor, 4 ft. 8 in.; back and front same height; staircase windows are each 6 ft. high. The width of each front window is 4 ft., and of each back window 3 ft. 6 in. Required the cost of glazing at 11½d. per foot.
- (4) What will be the cost of paving a kitchen measuring 12 ft. 6 in. by 10 ft. 4 in. at 11s. 3d. per square yard?

WINTER IN RUSSIA (THE FROZEN MARKET).

(From the 'Russians at Home,' by Sutherland Edwards.)

con-ge-la'-tion, the act of freezing
gro-tesque, ludicrous, whimsical
im-pu'-ni-ty, freedom from punishment
in-ver't, to turn upside down

poise, to balance, to weigh
cat'-e-go-ry, a class, a series of ideas
im'-pro-viso, to do a thing without previous arrangement or plan

It is said that people see the cold in Russia, and feel it in Italy. When I was in Russia I certainly saw the cold, and it did not appear at all necessary to go to Italy in order to feel it. Still, so great and effective are the precautions taken against

the common enemy, that when fortified behind double, or perhaps treble, windows in a thick-walled house, and protected in your occasional sorties by a stout armour of fur, you have nothing to fear from the attacks of this most unmerciful assailant. Russia in the summer is no more like Russia in the winter than a camp in time of peace is like a camp in presence of the enemy. Moreover, snow is one of the chief natural productions of the country; and without it Russia is as uninteresting as an orchard without fruit. We always think of Russia in connection with its frosts, and of its frosts in connection with such great events as the campaign of 1812,* or the visit of the deputation from the Peace Society to the Emperor Nicholas.† Accordingly, a foreigner in Russia naturally looks forward to the winter with much interest, mingled perhaps with a certain amount of awe. He waits for it, in fact, as a man waits for a thief, expecting the visitor with a certain kind of apprehension, and not without a due provision of life-preservers in the shape of goloshes, seven-leagued boots, scarves, fur coats, &c.

There was a fall of snow, and the cream was brought in from the country in jars wrapped carefully round with matting to prevent its freezing. Hundreds of cabbages and thousands of potatoes, similarly protected, were purchased and stowed away. Furlongs of wood (in Russia wood is sold by the foot) were laid up in the courtyard; an inspector of stoves arrived to see that every peitchka was in proper working order; and an examiner and fitter-in of windows was summoned to adjust the usual extra sash. At last the windows had been made fast, each pane being at the same time reputtied into its frame. On the window-sill, in the space between the outer and inner panes, was something resembling a long deep line of snow, which was, however, merely a mass of cotton-wool placed there as an additional protection against the external air. Indeed, the winds of the Russian winter have such powers of penetration that, in a room guarded by triple windows, besides shutters closed with the greatest exactness, I have seen the curtains slightly agitated when the howling outside was somewhat louder than usual. 'The wind,' says Gregorovitch in his 'Winter's Tale,' 'howls like a dog; and like a dog will bite the feet and calves of those who have not duly provided themselves with fur-goloshes and doubly-thick pantaloons.' Such a wind must not be suffered to intrude into any house intended to be habitable.

Besides the cotton-wool, which is a special provision against

* The invasion of Russia by Napoleon I.

† During the Crimean war.

draughts, the space between the two saases is usually adorned with artificial flowers: indeed, the fondness of the Russians for flowers and green leaves during the winter is remarkable. The corridors are converted into greenhouses, by means of trellis-work covered with creepers. The windows of many of the apartments are encircled by evergreens, and in the drawing-rooms, flower-stands form the principal ornaments. At the same time enormous sums are paid for bouquets from the hot-houses which abound in both the capitals. Doubtless the long winters have some share in the production of this passion for flowers and green plants, just as love of country is increased by exile, and love of liberty by imprisonment.

There are generally at least two heavy snow-storms by way of warning before winter fairly commences its reign. The first fall of snow thaws perhaps a few days afterwards, the second in about a week, the third in five months. If a lady drops her bracelet or brooch in the street during the period of this third fall, she need not trouble herself to put out handbills offering a reward for its discovery, at all events not before the spring; for it will be preserved in its hiding-place, as well as ice can preserve it, until about the middle of April, when, if the amount of the reward be greater than the value of the article lost, it will in all probability be restored to her. The Russians put on their furs at the first signs of winter, and the sledges make their appearance in the streets as soon as the snow is an inch or two thick. Of course at such a time a sledge is far from possessing any advantage over a carriage on wheels; but the Russians welcome their appearance with so much enthusiasm, that the first sledge-drivers are sure of excellent receipts for several days. The droshkies disappear one by one with the black mud of autumn; and by the time the gilt cupolas of the churches, and the red and green roofs of the houses, have been made whiter than their own walls, the city swarms with sledges. It is not, however, until near Christmas, when the 'frost of St. Nicholas' sets in, that they are seen in all their glory. The earliest frosts of October and November may or may not be attended to without any very dangerous results ensuing; but when the frigid St. Nicholas makes his appearance—staying the most rapid currents, forming bridges over the broadest rivers, and converting seas into deserts of ice—then a blast from his breath, if not properly guarded against, may prove fatal. However, foreigners alone are afraid of him. He is the Russian's best friend. Of the Russian peasant he is not only the patron saint, but also the real benefactor. He is the greatest engineer in the country, and does more in the department of roads and bridges in a single night than the notorious Kleinmichel did in the whole course of his ministry.

But when he approaches you, you must not go out to meet him otherwise than in a garment of fur, or the disrespect may be visited upon you with severity. This is the sole return he requires for his services in enabling you to receive the veal of Archangel and the beef of the Steppes, which can only be transported in winter along his excellent roads. . . .

The Frozen Market is one of the most curious in Moscow, which abounds in markets of a curious kind. . . . But none of these markets are so strikingly Russian as the Frozen Market. It is not until the fête of St. Nicholas—or later still, the week between Christmas and the new year—that this strange exhibition is to be seen in all its glory. By that time the severe period of winter has fairly set in. The soldiers, tall, stalwart men, are wearing their long grey coats over their heavy knap-sacks, which bulge out and make them look like so many hunchbacks; while the broad black bandages which protect their ears and cheeks give them the appearance of persons suffering from toothache. The cold has indeed had some effect upon them; for as they march in from the country, their raw faces are as red as beef, and their frozen moustaches as white as horseradish. Every moujik with his long and literally snow-white beard looks like an allegorical figure of winter. The blackest horses are now piebald, thanks to the hoar-frost which has decorated their sides; while the congelation of their breath round the long hairs that project from their nostrils adds to the peculiarity of their appearance, and furnishes them with a set of spikes such as calves wear in weaning time.

But although the drivers and horses of the sledges, as they hurry towards the market-place, form a by no means uninteresting part of the exhibition, their loads, when taken out and arranged with a view to sale, present a picture which is far more striking. On one side you see a collection of frozen sheep—stiff, ghastly objects—some poised on their hoofs like the wooden animals in a child's 'Noah's Ark'; others on their sides, with their legs projecting exactly at right angles to their bodies; others, again, on their backs, with their feet in the air, after the manner of inverted tables. The oxen are only less grotesque from having been cleft down the back—an operation which seems to take them out of the category of oxen and place them in that of beef. The pigs are drawn up in line against a wall, standing on their hind-legs with their forefeet extended above their heads, in an attitude of exhortation.

Among the poultry and game, the hares are especially remarkable, from the fact that their fur, which through the summer is either brown or grey, has at the approach of winter turned completely white—a provision of nature which enables the Russian and Siberian hure to travel through the snow in

quest of food with a certain amount of impunity, though for all that it never fails to be represented at the winter markets of Moscow and St. Petersburg. The partridges, quails, grouse, heathcocks, woodhens, &c. are lying together in a frozen mass; and by their side are the ducks and geese, with outstretched neck, so straight and stiff that you might take one of these harmless birds by the bill, and, using it as a bludgeon, knock your enemy down with the body. The fowls have been plucked, plunged into water, and left to freeze. Thus they are completely encased in ice, and in that condition will keep for any time. And to think that Newton * wished to satisfy himself by experiment that fowls could be so preserved, and that the experiment cost him his life! What would a moujik think of such a philosopher? Besides game of every kind, not only from the neighbouring governments, but even from Finland and Siberia, the markets of St. Petersburg and Moscow are supplied with fish from every sea and river in the empire. Lomonosof, the earliest Russian poet, the author of the first Russian dictionary, and one of the most celebrated chemists and natural philosophers the country ever produced, made his first appearance in St. Petersburg with a sledge-load of fish from the White Sea, where his father gained his living as a fisherman. The Black Sea and the Caspian also contribute largely. The Don sends its sturgeons, after the roe has been duly extracted for the purpose of making caviar; and the Volga its rich, oily, yellow-fleshed sterlet, invaluable for fish-soup. The presence of the sterlet is the more welcome in the winter markets from the fact that this delicately-organised and exquisitely-flavoured fish will only live in the water of the Volga. But in winter there is no necessity for it to live at all after it has once been caught, as it can be conveyed in its frozen state to the extremities of the empire without losing any of its freshness, or any very perceptible amount of its taste.

The mode of catching fish in the winter is simple enough: a hole is made in the ice, and the fish rush to it for the sake of the air. Then, in the case of the sturgeons of the Don, the Cossacks 'of that ilk' harpoon them; while elsewhere the smaller fish, equally in want of air, precipitate themselves in the nets that await them, and thus get, if not out of the frying-pan into the fire, at least out of the ice into the frying-pan.

Another peculiarity of the Frozen Market is, that it takes place in the middle of an improvised wood—a wood which suggests the forest in 'Macbeth,' and which is composed entirely of evergreens for Christmas trees. Beneath the shade of

* This is stated of Bacon, who caught cold while stuffing a fowl with snow in order to try this experiment.—Ed.

this portable thicket are sold brooms, wooden spades for clearing away the snow from before the houses, and the hand-aledges in which servants and shopmen draw their parcels through the streets; for it would be out of the question to carry anything at all heavy or cumbersome when by such simple means it may be pulled with ease along the slippery ground. Nor must I forget the itinerant vendors of sucking-pigs, who start from the Frozen Market with whole litters of the interesting little animals, not much larger than guinea-pigs, hanging from their necks and waists; nor the dealers in dried mushrooms, who string those leathern delicacies together like pieces of brown paper on the tail of a kite, and wear them in garlands about their sheep-skinned persons. A similar kind of pedlar is to be found in the man, who is hung all over with chains and rings of thin whity-brown bread—doubtless a friend to the owner of the tumbler and tea-urn, who walks about the commercial quarter and sells hot tea to the bearded and cat-taned merchants.

MENSURATION.

- (1) How much carpet, 3 qrs. wide, would be required to cover the floor of a room 15 ft. 6 in. by 22 ft., and what would it cost at 3s. 9d. per yard?
- (2) What would be the cost of papering the above room, the height being 12 ft.; allowing for two doors, each 3 ft. by 6 ft. 6 in., and two fireplaces, each 5 ft. by 5 ft., at 3½d. per square yard?
- (3) What would the glazing of eighteen sash-frames cost, each containing 16 squares 10 in. by 12 in., at 2½d. per foot?
- (4) What would be the cost of flagging a triangular yard, the base being 29 ft. and the perpendicular 17 ft., at 2s. 4d. per square yard?

THE BATTLE OF CORUÑA.

(From the 'Battles of the Peninsula,' by Sir W. Napier.)

vet'-er-ans, old soldiers
inf'-ant-ry, foot soldiers
pic'-quets, outposts
ve'-he-men-ee, force, passion
men'-ace, to threaten
sub'-tle-ty, craftiness
bat'-tal'-i-on, a body of foot soldiers, from
600 to 1,000 men
re-in-forc'-ment, the bringing up of
new forces
as-sail'-ant, one who makes an attack
con-sum'-mate, complete

gren-a-dier', a soldier whose duty it formerly was to throw grenades or explosive shells among the enemy
al-le-vi-a'-tion, a soothing of pain
E'-pam-i-non-das, a celebrated Theban general, of whom it is recorded that he never told a lie
ma-lig'-nant, spiteful, cruel
ir-re-fra'-ga-ble, that cannot be contradicted
an-ti'-qui-ty, great age, the earliest times

On the 16th of January 1809, at two o'clock in the afternoon, twenty thousand French veterans opened this battle against fourteen thousand British, who, having but nine six-pounders to oppose to a numerous light artillery, were also galled by

eleven heavy guns on the rocks; and soon that formidable battery opened the fight with a slaughtering fire, sending its bullets crashing through the English ranks from right to centre. Then the columns of infantry, throwing out clouds of skirmishers, descended from their strong ridge to the fight. Those coming from Palavia and Portosa, having some distance to march, did not immediately engage, but the third dashed at once against Elvina, and there was the stress of battle; the picquets were driven in heaps out of the village, and when that was passed the French mass divided, one portion advancing against Baird's front, the other turning his right by the valley, where it was only opposed by the screen of light troops.

Sir John Moore sent the 42nd and 50th Regiments against the half column at Elvina, and wheeling back the 4th Regiment on the extremity of his right, poured a fire into the flank of the mass penetrating by the valley, where it was also stoutly opposed by the light troops, and soon abated of its vehemence in attack. Then the English general knew that his adversary's whole force and order of battle was unfolded. No infantry menaced the valley from where the French cavalry stood, and the number in front showed that no body of strength for mischief was behind those heights: it was evident that Soult offered a close rough trial of arms, without subtlety, trusting to the valour of his veterans. Eagerly the gallant Moore accepted the challenge. The moment for his counter-stroke had arrived, and at once he called up Frazer's division in support of Paget, giving the latter, who was previously well instructed, the signal to descend into the valley. The French column on his flank being thus provided with opponents, he turned to observe the progress of the fight at Elvina, for as yet the battle had but slightly touched his centre and left.

The 42nd and 50th had driven the enemy back into the village, and the last-named regiment, entering the streets with the repulsed disordered mass and giving no respite, forced it through, and broke out, still fighting, on the other side. To support this advance the general now sent a battalion of the Guards down, whereupon the 42nd, thinking it a relief and not a reinforcement, retired, with the exception of the grenadier company. Some confusion thus occurred, the village was not occupied, and the 50th, still accompanied by the 42nd grenadiers, were engaged without support beyond the houses, their array being quite broken by stone enclosures and the disorder of the street fight. At that critical moment the French were strongly reinforced, retook the offensive, and forced the regiment back into Elvina, having killed beyond it the second major, Stanhope, a nephew of Mr. Pitt, and made prisoner the commanding officer, Major Napier, known since as the con-

queror of Scinde; encompassed by enemies, and denied quarter, he received five wounds, but he still fought and struggled for life, till a French drummer, with a generous heat and indignation, forcibly rescued him from his barbarous assailants. Meanwhile Sir John Moore, observing the error of the 42nd, had galloped down, and with a fiery exhortation sent it back to the village, where the 50th, notwithstanding the loss of their commander, was successfully maintaining a very violent conflict: then with heroic anticipations from the development of his counter-combination, he returned to the ridge from whence he could view the whole action. Elvina was now his centre of battle and pivot of movements, for on his left the battle had then become general and furious, yet the French made no progress against Hope's division; and on the right, in the valley, the attacking column was at bay, wavering under a double fire in front and flank: everywhere the signs of coming victory were bright, when the gallant man, the consummate commander, who had brought the battle to this crisis, was dashed from his horse to the earth. A cannon-shot from the rock battery had torn away all the flesh from his left breast and shoulder, and broken the ribs over a heart undaunted even by this terrible, this ghastly mortal hurt; for with incredible energy he rose to a sitting posture, and with fixed look and unchanged countenance continued to regard the fight at Elvina until the Frenchmen's backward steps assured him the British were victorious: then sinking down he accepted succour.

Being placed in a blanket for removal, an entanglement of his belts caused the hilt to enter the wound, and Captain Hardinge attempted to take away the weapon altogether; but with martial pride the stricken man forbade the alleviation—he *would not part with his sword in his field!* Epaminondas, mortally wounded at Mantinea, was anxious for the recovery of his shield. Moore, mortally wounded at Coruña, sustained additional torture rather than part with his sword!

Theban hero's fall dismayed and paralysed his victorious troops. It was not so with the British at Coruña. They saw Baird, second in command, carried from the field as the general-in-chief had been, and they would have seen all their generals fall one after another without abating their battle; hence it was not long before the French were entirely driven from Elvina, while on the left, they were not only repulsed from the ridge, but pursued and assailed in their own villages; that of Palavia, defended by the since celebrated General Foy, was taken. Meanwhile Paget, pouring into the valley with conquering violence, overthrew everything in his front, and driving off the dismounted French dragoons who had descended to the lower falls on his right, made for the great rock battery, which he would certainly have stormed if the counter-attack had

been continued, and Frazer's division been thrown, as Moore designed, into the fight. The French would thus have been wrecked; for their ammunition, of which the rapid marches through Galicia had only allowed them to bring up a small supply, was exhausted, the river Mero was in full tide behind them, and only one bridge remained for retreat. But this want of ammunition was unknown to the English general Hope, on whom the command had devolved, and he, judging a night action, for it was then dark, too hazardous, profited from the confusion of the French to embark the army without loss, and sailed for England. The heroic spirit of Moore went with his troops, his body rested with the enemy.

For some hours after receiving his hurt that great man had lived painfully, but with a calm fortitude that excited the admiration of those about him. Several times he expressed his satisfaction at having won the battle, and his last words were to express a hope '*that his country would do him justice!*'

Full justice has not been done, because malignant faction has strived hard to sully his reputation as a general; but thus he died, and the record of his worth will be as a beacon to posterity so long as heroic virtue, combined with great capacity, is revered; for in any age, any nation, any conjuncture, Sir John Moore would have been a leading man. Tall he was and vigorous of person, and of a very comely noble aspect, indicating penetration which no subtlety could deceive, valour which no danger could appal, and withal a dignity of mind which awed while it attracted admiration and confidence. With him, indeed, all commanding qualities seemed to be united to, and inseparable from, estimable sentiments. Integrity, honour, generosity, patriotism, adorned the whole course of his existence, and his death furnished an irrefragable test of the sincerity of his life; for both he may claim a place with the greatest men of antiquity.

MISCELLANEOUS EXAMPLES.

- (1) How many cart-loads of coal, each 5 cwt. 16 lbs., can be supplied from a keel of 20 tons 6 cwt. 1 qr. 4 lbs.?
- (2) If 204 men build a wall 306 ft. long, 8 ft. high, and 3 ft. thick, in 42 days of 6 hours each, in how many days of 8 hours each will 188 men build a wall of 6 ft. high, and 18 in. thick round a rectangular enclosure whose length is 319 ft. and breadth 97 ft.?
- (3) If I gain 16 per cent. by selling 98 yards of cloth for £23 13s. 8d. what was the cost price per yard?
- (4) A diamond-shaped kite, 2 ft. broad, and 4 ft. long, is covered on one face with gold leaf, which is sold in pieces 4 in. square; how many leaves does it take?
- (5) What must be added to $\cdot 356$ of £2 17s. 10d. to make up $\frac{1}{2}$ of £8 19s. 7½d.?

A SKETCH OF MODERN ASTRONOMY

(concluded).

(By Dr. Chalmers.)

al-ter'-nate, *by turns*
 ret'-i-nue, *a train of attendants*
 ex-pa'-ti-ate, *to enlarge on*
 con-cep'-tion, *a notion*
 con-jec'-tu-ral, *depending on guess or supposition*
 phe-nom'-e-non (Gr.), plu. phe-nom'-e-na, *any extraordinary appearance in the works of nature*
 mech'-an-ism, *the principles of construction*

re-cip'-ro-cal, *mutual, alternate*
 a-byss', *a fathomless gulf or pit*
 can'-o-py (n.), *the sky*
 in-fin'-i-ty, *endless number or size*
 per-cus'-sion, *the act of striking; a stroke*
 co-e'-val, *of the same age with*
 em'-a-nate, *to issue from*
 cen-tri'-fu-gal, *flying from the centre*
 an-te'-ri-or, *previous*
 con-tig'-u-ous, *near, meeting so as to touch*

BUT what can those stars be which are seated so far beyond the limits of our planetary system? They must be masses of immense magnitude, or they could not be seen at the distance of place which they occupy. The light which they give must proceed from themselves, for the feeble reflection of light from some other quarter would not carry through such mighty tracks to the eye of an observer. A body may be visible in two ways. It may be visible from its own light, as the flame of a candle, or the brightness of a fire, or the brilliancy of yonder glorious sun which lightens all below, and is the lamp of the world. Or it may be visible from the light which falls upon it—as the whole assemblage of objects on the surface of the earth, which appear only when the light of day rests upon them—or the moon, which, in that part of it that is towards the sun, gives out a silvery whiteness to the eye of the observer, while the other part forms a black and invisible space in the firmament—or as the planets, which shine only because the sun shines upon them, and which, each of them, present the appearance of a dark spot on the side that is turned away from it. Now apply this question to the fixed stars. Are they luminous of themselves, or do they derive their light from the sun, like the bodies of our planetary system? Think of their immense distance, and the solution of this question becomes evident. The sun, like any other body, must dwindle into a less apparent magnitude as you retire from it. At the prodigious distance even of the very nearest of the fixed stars, it must have shrunk into a small indivisible point. In short, it must have become a star itself, and could shed no more light than a single individual of those glimmering myriads, the whole assemblage of which cannot dissipate, and can scarcely alleviate, the midnight darkness of our world. These stars are visible to us, not because the sun shines upon them, but be-

cause they shine of themselves; because they are so many luminous bodies scattered over the tracks of immensity—in a word, because they are so many suns, each throned in the centre of his own dominions, and pouring a flood of light over his own portion of these unlimitable regions.

At such an immense distance for observation, it is not to be supposed that we can collect many points of resemblance between the fixed stars and the solar star which forms the centre of our planetary system. There is one point of resemblance, however, which has not escaped the penetration of our astronomers. We know that our sun turns round upon himself, in a regular period of time. We also know that there are dark spots scattered over his surface, which, though invisible to the naked eye, are perfectly noticeable by our instruments. If these spots existed in greater quantity upon one side than upon another, it would have the general effect of making that side darker, and the revolution of the sun must, in such a case, give us a brighter and a fainter side, by regular alternations. Now, there are some of the fixed stars which present this appearance. They present us with periodical variations of light. From the splendour of a star of the first or second magnitude, they fade away into some of the inferior magnitudes—and one, by becoming invisible, might give reason to apprehend that we had lost him altogether—but we can still recognise him by the telescope, till at length he reappears in his own place, and, after a regular lapse of so many days and hours, recovers his original brightness. Now the fair inference from this is, that the fixed stars, as they resemble our sun in being so many luminous masses of immense magnitude, they resemble him in this also, that each of them turns round upon his own axis; so that if any of them should have an inequality in the brightness of their sides, this revolution is rendered evident by the regular variations in the degrees of light which it undergoes.

Shall we say, then, of these vast luminaries, that they were created in vain? Were they called into existence for no other purpose than to throw a tide of useless splendour over the solitudes of immensity? Our sun is only one of these luminaries, and we know that he has worlds in his train. Why should we strip the rest of this princely attendance? Why may not each of them be the centre of his own system, and give light to his own worlds? It is true that we see them not; but could the eye of man take its flight into those distant regions, it should lose sight of our little world before it reached the outer limits of our system—the greater planets should disappear in their turn—before it had described a small portion of that abyss which separates us from the fixed stars, the sun should decline into a little spot, and all its splendid retinue of worlds be lost

in the obscurity of distance—he should at last shrink into a small indivisible atom, and all that could be seen of this magnificent system should be reduced to the glimmering of a little star. Why resist any longer the grand and interesting conclusion? Each of these stars may be the token of a system as vast and as splendid as the one which we inhabit. Worlds roll in these distant regions; and these worlds must be the mansions of life and intelligence. In yon gilded canopy of heaven, we see the broad aspect of the universe, where each shining point presents us with a sun, and each sun with a system of worlds—where the Divinity reigns in all the grandeur of His high attributes—where He peoples immensity with His wonders, and travels in the greatness of His strength through the dominions of one vast and unlimited monarchy.

The contemplation has no limits. If we ask the number of suns and of systems—the unassisted eye of man can take in a thousand, and the best telescope which the genius of man has constructed can take in eighty millions. But why subject the dominions of the universe to the eye of man, or to the powers of his genius? Fancy may take its flight far beyond the ken of eye or of telescope. It may expatiate on the outer regions of all that is visible—and shall we have the boldness to say, that there is nothing there? that the wonders of the Almighty are at an end because we can no longer trace His footsteps? that His omnipotence is exhausted, because human art can no longer follow Him? that the creative energy of God has sunk into repose, because the imagination is enfeebled by the magnitude of its efforts, and can keep no longer on the wing through those mighty tracks, which shoot far beyond what eye hath seen, or the heart of man hath conceived—which sweep endlessly along, and merge into an awful and mysterious infinity?

But before bringing to a close this rapid and imperfect sketch of our modern astronomy, it may be right to advert to two points of interesting speculation, both of which serve to magnify our conceptions of the universe, and, of course, to give us a more affecting sense of the comparative insignificance of this our world. The first is suggested by the consideration that, if a body be struck in the direction of its centre, it obtains, from this course, a progressive motion, but without any movement of revolution being at the same time impressed upon it. It simply goes forward, but does not turn round upon itself. But, again, should the stroke not be in the direction of the centre—should the line which joins the point of percussion to the centre make an angle with that line in which the impulse was communicated by one blow, then the progressive motion must go along with it. In order to have the first motion without the second, there must be a twofold force applied to the body in opposite directions. It must be set a-going in the same way

a spinning-top, so as to revolve about an axis, and to keep unchanged its situation in space. The planets have both motions; and, therefore, may have received them by one and the same impulse. The sun, we are certain, has one of these motions. He has a movement of revolution. If spun round his axis by two opposite forces, one on each side of him, he may have this movement, and retain an inflexible position in space. But, if this movement was given him by one stroke, he must have a progressive motion along with a whirling motion, or, in other words, he is moving forward; he is describing a track in space; and, in so doing, he carries all his planets and all their secondaries along with him.

But, at this stage of the argument, the matter only remains a conjectural matter of speculation. The sun may have had his rotation impressed upon him by a spinning impulse; or, without recurring to secondary causes at all, this movement may be coeval with his being, and he may have derived both the one and the other from an immediate fiat of the Creator. But there is an actually observed phenomenon of the heavens, which advances the conjecture into a probability. In the course of ages, the stars in one quarter of the celestial sphere are apparently receding from each other; and, in the opposite quarter, they are apparently drawing nearer to each other. If the sun be approaching the former quarter, and receding from the latter, this phenomenon admits of an easy explanation, and we are furnished with a magnificent step in the scale of the Creator's workmanship. In the same manner as the planets, with their satellites, revolve round the sun, may the sun, with all its tributaries, be moving, in common with other stars, around some distant centre, from which there emanates an influence to bind and to subordinate them all. They may be kept from approaching each other by a centrifugal force, without which the laws of attraction might consolidate into one stupendous mass all the distinct globes of which the universe is composed. Our sun may, therefore, be only one member of a higher family—taking his part, along with millions of others, in some loftier system of mechanism, by which they are all subjected to one law and to one arrangement—describing the sweep of such an orbit in space, and completing the mighty revolution in such a period of time, as to reduce our planetary seasons and our planetary movements to a very humble and fractionary rank in the scale of a higher astronomy. There is room for all this in immensity; and there is even argument for all this, in the records of actual observation; and from the whole of this speculation do we gather a new emphasis to the lesson, how minute is the place and how secondary is the importance of our world, amid the glories of such a surrounding magnificence.

But there is still another very interesting track of speculation which has been opened up to us by the more recent observations of astronomy. What we allude to is the discovery of the *nebulae*. We allow that it is but a dim and indistinct light which this discovery has thrown upon the structure of the universe; but still it has spread before the eye of the mind a field of very wide and lofty contemplation. Anterior to this discovery, the universe might appear to have been composed of an indefinite number of suns, about equidistant from each other, uniformly scattered over space, and each encompassed by such a planetary attendance as takes place in our own system. But we have now reason to think that, instead of lying uniformly, and in a state of equidistance from each other, they are arranged into distinct clusters—that, in the same manner as the distance of the nearest fixed stars so inconceivably superior to that of our planets from each other, marks the separation of the solar systems; so the distance of two contiguous clusters may be so inconceivably superior to the reciprocal distance of those fixed stars which belong to the same cluster, as to mark an equally distinct separation of the clusters, and to constitute each of them an individual member of some higher and more extended arrangement. This carries us up through another ascending step in the scale of magnificence, and there leaves us wildering in the uncertainty, whether even here the wonderful progression is ended; and, at all events, fixes the assured conclusion in our minds, that to an eye which could spread itself over the whole, the mansion which accommodates our species might be so very small as to lie wrapped in microscopical concealment; and, in reference to the only Being who possesses this universal eye, well might we say, ‘What is man that thou art mindful of him, or the son of man that thou shouldst deign to visit him?’

MISCELLANEOUS EXAMPLES.

- (1) If a loaf weighing 48 oz. cost $8\frac{1}{2}d.$ when wheat is at 60s. a quarter, what should be the price of wheat when a 6d. loaf weighs 32 oz. 8 dwt.?
- (2) I have £2,400 in the Three per Cents.; I sell out at $90\frac{1}{2}$, and invest the money in debentures, paying $5\frac{1}{2}$ per cent.,—purchasing them at 111; what is the difference in annual income?
- (3) What must be the depth of a cylindrical tank to hold 50,000 gallons, its diameter being 12 ft.?
- (4) How many parcels of sugar of 2 lbs., 1 lb., $\frac{1}{2}$ lb., and $\frac{1}{4}$ lb. can be made out of a cask containing 8 cwt. 2 qrs., the number of each being equal?
- (5) If two men, A. and B., together can perform a piece of work in 10 days, and A. by himself can do it in 18 days, what time will it take B. to do it?

SELECTIONS FROM THE POEMS OF WORDS-
WORTH, COLERIDGE, SOUTHEY, & MOORE.

THE TWO APRIL MORNINGS.

(William Wordsworth.)

[Born, 1770; died, 1850. Poems: 'The Evening Walk,' 'The Excursion,'
Sonnets, &c.]

cleft (n.), a split, a crack
 be-nign', kind, generous
 har'-bin-ger, a forerunner
 con-ta'-gion, the communication of dis-
 ease by the touch

me'-te-or, a luminous body passing
 through the air
 Al'-la, the name given by the Mahome-
 tans to God

We walk'd along, while bright and red,
 Uprose the morning sun;
 And Matthew stopp'd, he look'd, and said,
 'The will of God be done!'

A village schoolmaster was he,
 With hair of glittering gray;
 As blithe a man as you could see
 On a spring holiday.

And on that morning through the grass
 And by the steaming rills
 We travell'd merrily, to pass
 A day among the hills.

'Our work,' said I, 'was well begun,
 Then from thy breast what thought,
 Beneath so beautiful a sun,
 So sad a sigh has brought?'

A second time did Matthew stop,
 And fixing still his eye
 Upon the eastern mountain-top,
 To me he made reply,—

'Yon cloud with that long purple cleft,
 Brings fresh into my mind
 A day like this, which I have left
 Full thirty years behind,

'And just above that slope of corn
 Such colours, and no other,
 Were in the sky that April morn
 Of this the very brother.

' With rod and line I sued the sport
Which that sweet season gave,
And coming to the church, stopp'd short
Beside my daughter's grave.

' Nine summers had she scarcely seen,
The pride of all the vale;
And then she sang—she would have been
A very nightingale.

' Six feet in earth my Emma lay,
And yet I loved her more,
For so it seem'd, than till that day
I e'er had loved before.

' And turning from her grave, I met
Beside the churchyard yew
A blooming girl, whose hair was wet
With points of morning dew.

' A basket on her head she bare;
Her brow was smooth and white:
To see a child so very fair,
It was a pure delight!

' No fountain from its rocky cave
E'er tripp'd with foot so free;
She seem'd as happy as a wave
That dances on the sea.

' There came from me a sigh of pain
Which I could ill confine;
I look'd at her, and look'd again,
And did not wish her mine!

Matthew is in his grave, yet now
Methinks I see him stand
As at that moment, with a bough
Of wilding in his hand.

THE BEAUTIFUL LADY.

(*Samuel Taylor Coleridge.*)

born, 1772; died, 1834. Chief poems: 'Ode to the Departing Year,' 'France,'
'Isabel,' 'The Ancient Mariner,' &c.]

The night is chill, the forest bare;
Is it the wind that moaneth bleak?
There is not wind enough in the air
To move away the ringlet curl

From the lovely lady's cheek;
There is not wind enough to twirl
The one red leaf, the last of its clan,
That dances as often as dance it can,
Hanging so light, and hanging so high,
On the topmost twig that looks up at the sky.

Hush, beating heart of Christabel!
Jesu Maria, shield her well!
She foldeth her arms beneath her cloak,
And steals to the other side of the oak.
What sees she there?

There she sees a damsel bright,
Dressed in a silken robe of white,
That shadowy in the moonlight shone;
The neck that made that white robe wan,
Her stately neck and arms were bare;
Her blue-veined feet unsandalled were,
And wildly glittered here and there
The gems entangled in her hair.
I guess 'twas frightful there to see
A lady so richly clad as she—
Beautiful exceedingly!

Christabel.

BROKEN FRIENDSHIP.

Alas! they had been friends in youth;
But whispering tongues can poison truth;
And constancy lives in realms above:
And life is thorny, and youth is vain,
And to be wroth with one we love,
Doth work like madness in the brain.
And thus it chanced, as I divine,
With Roland and Sir Leoline,
Each spake words of high disdain
And insult to his heart's best brother.
They parted—ne'er to meet again!
But never either found another
free the hollow heart from paining:
They stood aloof, the scars remaining,
Like cliffs which had been rent asunder:
A dreary sea now flows between.
But neither heat, nor frost, nor thunder,
Shall wholly do away, I ween,
The marks of that which once hath been.

Christabel.

THE WIDOWED MOTHER.

(Robert Southey.)

[Born, 1774; died, 1843. Works, very voluminous. 'Thalaba the Destroyer,' 'Metrical Tales,' 'Madoc,' 'The Curse of Kehama,' 'Roderick,' &c.]

I.

How beautiful is night!
 A dewy freshness fills the silent air;
 No mist obscures, nor cloud, nor speck, nor stain,
 Breaks the serene of heaven:
 In full-orbed glory, yonder moon divine
 Rolls through the dark-blue depths.
 Beneath her steady ray
 The desert-circle spreads,
 Like the round ocean, girdled with the sky.
 How beautiful is night!

II.

Who, at this untimely hour,
 Wanders o'er the desert sands?
 No station is in view,
 Nor palm-grove islanded amid the waste.
 The mother and her child,
 The widowed mother and the fatherless boy,
 They, at this untimely hour,
 Wander o'er the desert sands.

III.

Alas! the setting sun
 Saw Zeinab in her bliss,
 Hodeirah's wife beloved,
 The fruitful mother late,
 Whom, when the daughters of Arabia named,
 They wished their lot like hers:
 She wanders o'er the desert sands
 A wretched widow now,
 The fruitful mother of so fair a race;
 With only one preserved,
 She wanders o'er the wilderness.

IV.

No tear relieved the burden of her heart ;
 Stunned with the heavy woe, she felt like one
 Half wakened from a midnight dream of blood.

But sometimes, when the boy
 Would wet her hands with tears,
 And, looking up to her fixed countenance,
 Sob out the name of mother, then did she
 Utter a feeble groan.

At length, collecting, Zeinab turned her eyes
 To Heaven, exclaiming, ' Praised be the Lord !

He gave, He takes away !
 The Lord our God is good.'

Thalaba the Destroyer.

THE TEAR OF PENITENCE.

(*Thomas Moore.*)

[Born, 1780 ; died, 1852. Works : ' Odes and Epistles,' ' Twopenny Post-bag,'
 ' Fudge Family in Paris,' ' Irish Melodies,' ' Lalla Rookh,' ' Life of Byron, &c.]

And how felt he, the wretched man
 Reclining there—while memory ran
 O'er many a year of guilt and strife,
 Flew o'er the dark flood of his life,
 Nor found one sunny resting-place,
 Nor brought him back one branch of grace !
 ' There was a time,' he said in mild,
 Heart-humbled tones, ' thou blessed child !
 When young and haply pure as thou,
 I looked and prayed like thee—but now'—
 He hung his head ; each nobler aim

And hope and feeling, which had slept
 From boyhood's hour, that instant came
 Fresh o'er him, and he wept—he wept !
 Blest tears of soul-felt penitence !

In whose benign redeeming flow
 Is felt the first—the only sense

Of guiltless joy that guilt can know.

' There's a drop,' said the Peri, ' that down from the moon
 Falls through the withering airs of June
 Upon Egypt's land, of so healing a power,
 Of so balmy a virtue, that even in the hour
 That drop descends, contagion dies,

And health reanimates earth and skies !
 Oh, is it not thus, thou man of sin,
 The precious tears of repentance fall ?
 Though foul thy fiery plagues within,
 One heavenly drop has dispelled them all !
 And now—behold him kneeling there
 By the child's side in humble prayer,
 While the same sunbeam shines upon
 The guilty and the guiltless one,
 And hymns of joy proclaim through heaven
 The triumph of a soul forgiven.

'Twas when the golden orb had set,
 While on their knees they lingered yet,
 There fell a light, more lovely far
 Than ever came from sun or star,
 Upon the tear that, warm and meek,
 Dewed that repentant sinner's cheek.
 To mortal eye this light might seem
 A northern flash or meteor beam ;
 But well the enraptured Peri knew
 'Twas a bright smile the angel threw
 From heaven's gate to hail that tear—
 Her harbinger of glory near !

'Joy, joy, for ever ! my task is done—
 The gates are passed, and heaven is won !
 Oh ! am I not happy, I am, I am.
 To thee, sweet Eden, how dark and sad
 Are the diamond turrets of Shadukiam,
 And the fragrant bowers of Amberabad !

Farewell, ye odours of earth that die,
 Passing away like a lover's sigh ;
 My feast is now of the tooba tree,
 Whose scent is the breath of eternity.

Farewell, ye vanishing flowers that shone
 In my fairy wreath, so bright and brief ;
 Oh, what are the brightest that e'er have blown,
 To the lote-tree springing by Alla's throne,
 Whose flowers have a soul in every leaf !
 Joy, joy, for ever ! my task is done—
 The gates are passed, and heaven is won !

Paradise and the Peri.

MISCELLANEOUS EXAMPLES.

- (1) A person loses at the rate of 10 per cent. by selling cloth at 15s. per yard; how ought it to have been sold to gain 20 per cent.?
- (2) If a pound weight of standard gold be worth £46 14s. 6d., how much should one sovereign weigh?
- (3) Three merchants make a stock of £700; their profits are respectively £23 1s. 5½d., £64 3s. 3¾d., and £39 8s. 7⅓d. How much did each contribute?
- (4) A cubic inch of water weighs 252·458 grains, and the weight of an imperial gallon is 10 lbs. avoirdupois. Find the number of cubic inches in an imperial gallon. (A pound avoirdupois is 7,000 grains.)
- (5) If a lump of iron weighing 16 cwt. 1 qr. 5 lbs. 5 oz. be rolled into a cylindrical bar 12 ft. long, find the diameter of the bar to three places of decimals. A cubic foot of iron weighs 7788 oz.

FROM PADUA TO VENICE.

(From the 'Stones of Venice,' by J. Ruskin.)

camp-a-nile, a bell-tower
 ar'-chi-trave, that part of a column which
 rests upon the upper part
 mi-ra-ge, an optical illusion in a desert or
 at sea
 stag-na'-tion, a standing still
 in-ter'-min-a-ble, endless
 des-e-cra'-ted, profaned, diverted from a
 sacred purpose
 mon-ot'-on-ous, wanting variety

con-vent'-u-al, relating to a convent
 vo-cif-er-a'-tion, violent outcry
 bast'-ion, a bulwark, a mass of earth
 standing out from a rampart
 e-quiv'-a-lent, equal in value
 dis-cor'-ant, inconsistent, not harmo-
 nious
 tes-se-la'-tion, the making of pavement in
 squares of different colours

COME with me, on an autumnal morning, through the dark gates of Padua, and let us take the broad road leading towards the east.

It lies level, for a league or two, between its elms and vine festoons full laden, their thin leaves veined into scarlet hectic, and their clusters deepened into gloomy blue; then mounts an embankment above the Brenta, and runs between the river and the broad plain, which stretches to the north in endless lines of mulberry and maize. The Brenta flows slowly, but strongly; a muddy volume of yellowish-grey water, that neither hastens nor slackens, but glides heavily between its monotonous banks, with here and there a short babbling eddy twisted for an instant into its opaque surface, and vanishing, as if something had been dragged into it and gone down. Dusty and shadeless, the road fares along the dyke on its northern side; and the tall white tower of Dolo is seen trembling in the heat mist far away, and never seems nearer than it did at first. Presently, you pass one of the much-vaunted 'villas on the

Brenta : ' a glaring spectral shell of brick and stucco, its windows with painted architraves like picture-frames, and a courtyard paved with pebbles in front of it, all burning in the thick glow of the feverish sunshine, but fenced from the high road, for magnificence sake, with goodly posts and chains; then another, of Kew Gothic, with Chinese variations, painted red and green; a third, composed for the greater part of dead wall, with fictitious windows painted upon it, each with a pea-green blind, and a classical architrave in bad perspective; and a fourth, with stucco figures set on the top of its garden wall; some antique, like the kind to be seen at the corner of the New Road, and some of clumsy grotesque dwarfs, with fat bodies and large boots. This is the architecture to which her studies of the Renaissance have conducted modern Italy.

The sun climbs steadily, and warms into intense white the walls of the little piazza of Dolo, where we change horses. Another dreary stage among the now divided branches of the Brenta, forming irregular and half-stagnant canals; with one or two more villas on the other side of them, but these of the old Venetian type, which we may have recognised before at Padua, and sinking fast into utter ruin, black, and rent, and lonely, set close to the edge of the dull water, with what were once small gardens beside them, kneaded into mud, and with blighted fragments of gnarled hedges and broken stakes for their fencing; and here and there a few fragments of marble steps, which have once given them graceful access from the water's edge, now settling into the mud in broken joints all aslope and alippery with green weed. At last the road turns sharply to the north, and there is an open space, covered with bent grass, on the right of it; but do not look that way.

Five minutes more, and we are in the upper room of the little inn at Mestre, glad of a moment's rest in shade. The table is (always, I think) covered with a cloth of nominal white and perennial grey, with plates and glasses at due intervals, and small loaves of a peculiar white bread, made with oil, and more like knots of flour than bread. The view from its balcony is not cheerful; a narrow street, with a solitary brick church and barren campanile on the other side of it; and some conventual buildings, with a few crimson remnants of fresco about their windows; and, between them and the street, a ditch with some slow current in it, and one or two small houses beside it, one with an arbour of roses at its door, as in an English tea-garden; the air, however, about us having in it nothing of roses, but a close smell of garlic and crabs, warmed by the smoke of various stands of hot chestnuts. There is much vociferation also going on beneath the window respecting certain wheelbarrows which are in rivalry for our

baggage; we appease their rivalry with our best patience, and follow them down the narrow street.

We have but walked some two hundred yards when we come to a low wharf or quay, at the extremity of a canal, with long steps on each side down to the water, which latter we fancy for an instant has become black with stagnation; another glance undeceives us—it is covered with the black boats of Venice. We enter one of them, rather to try if they be real boats or not than with any definite purpose, and glide away; at first feeling as if the water were yielding continually beneath the boat and letting her sink into soft vacancy. It is something clearer than any water we have seen lately, and of a pale green; the banks, only two or three feet above it, of mud and rank grass, with here and there a stunted tree, gliding swiftly past the small casement of the gondola, as if they were dragged by upon a painted scene.

Stroke by stroke, we count the plunges of the oar, each heaving up the side of the boat slightly as her silver beak shoots forward. We lose patience, and extricate ourselves from the cushions; the sea air blows keenly by, as we stand leaning on the roof of the floating cell. In front, nothing to be seen but long canal and level bank; to the west, the tower of Mestre is lowering fast, and behind it there have risen purple shapes, of the colour of dead rose-leaves, all round the horizon, feebly defined against the afternoon sky—the Alps of Bassano. Forward still: the endless canal bends at last, and then breaks into intricate angles about some low bastions, now torn to pieces and staggering in ugly rents towards the water—the bastions of the fort of Malghera. Another turn, and another perspective of canal, but not interminable. The silver beak cleaves it fast,—it widens; the rank grass of the banks sinks lower and lower, and at last dies in tawny knots along an expanse of weedy shore. Over it, on the right, but a few years back, we might have seen the lagoon stretching to the horizon, and the warm southern sky bending over Malamocco to the sea. Now we can see nothing but what seems a low and monotonous dockyard wall, with flat arches to let the tide through it; this is the railroad bridge, conspicuous above all things. But at the end of those dismal arches there rises, out of the wide water, a straggling line of low and confused brick buildings, which, but for the many towers which are mingled among them, might be the suburbs of an English manufacturing town. Four or five domes, pale, and apparently at a greater distance, rise over the centre of the line; but the object which first catches the eye is a sullen cloud of black smoke brooding over the northern half of it, and which issues from the belfry of a church. It is Venice.

In the olden days of travelling, now to return no more, in which distance could not be vanquished without toil, but in which that toil was rewarded, partly by the power of deliberate survey of the countries through which the journey lay, and partly by the happiness of the evening hours, when, from the top of the last hill he had surmounted, the traveller beheld the quiet village where he was to rest, scattered among the meadows beside its valley stream; or, from the long-hoped-for turn in the dusty perspective of the causeway, saw, for the first time, the towers of some famed city, faint in the rays of sunset, hours of peaceful and thoughtful pleasure, for which the rush of the arrival in the railway station is perhaps not always, or to all men, an equivalent; in those days, I say, when there was something more to be anticipated and remembered in the first aspect of each successive halting-place, than a new arrangement of glass roofing and iron girder, there were few moments of which the recollection was more fondly cherished by the traveller than that which, as I endeavoured to describe in the close of the last chapter, brought him within sight of Venice, as his gondola shot into the open lagoon from the canal of Mestre. Not but that the aspect of the city itself was generally the source of some slight disappointment, for, seen in this direction, its buildings are far less characteristic than those of the other great towns of Italy; but this inferiority was partly disguised by distance, and more than atoned for by the strange rising of its walls and towers out of the midst, as it seemed, of the deep sea; for it was impossible that the mind or the eye could at once comprehend the shallowness of the vast sheet of water which stretched away in leagues of rippling lustre to the north and south, or trace the narrow line of islets bounding it to the east. The salt breeze, the white moaning seabirds, the masses of black weed separating and disappearing gradually, in knots of heaving shoal, under the advance of the steady tide, all proclaimed it to be indeed the ocean on whose bosom the great city rested so calmly; not such blue, soft, lake-like ocean as bathes the Neapolitan promontories, or sleeps beneath the marble rocks of Genoa; but a sea with the bleak power of our own northern waves, yet subdued into a strange spacious rest, and changed from its angry pallor into a field of burnished gold, as the sun declined behind the belfry tower of the lonely island church, fitly named 'St. George of the Seaweed.' As the boat drew nearer to the city, the coast which the traveller had just left sank behind him into one long, low, sad-coloured line, tufted irregularly with brushwood and willows; but, at what seemed its northern extremity, the hills of Arqua rose in a dark cluster of purple pyramids, balanced on the bright mirage of the lagoon.

two or three smooth surges of inferior hill extended themselves about their roots, and beyond these, beginning with the craggy peaks above Vicenza, the chain of the Alps girded the whole horizon to the north—a wall of jagged blue, here and there showing through its clefts a wilderness of misty precipices, fading far back into the recesses of Cadore, and itself rising and breaking away eastward, where the sun struck opposite upon its snow, into mighty fragments of peaked light, standing up behind the barred clouds of evening, one after another, countless, the crown of the Adrian Sea, until the eye turned back from pursuing them, to rest upon the nearer burning of the campaniles of Murano, and on the great city where it magnified itself along the waves, as the quick silent pacing of the gondola drew nearer and nearer. And at last, when its walls were reached, and the outmost of its untrodden streets were entered, not through towered gate or guarded rampart, but as a deep inlet between two rocks of coral in the Indian sea; when first upon the traveller's sight opened the long ranges of columned palaces—each with its black boat moored at the portal—each with its image cast down, beneath its feet, upon that green pavement which every breeze broke into new fantasies of rich tessellation; when first, at the extremity of the bright vista, the shadowy Rialto threw its colossal curve slowly forth from behind the palace of the Camerlenghi, that strange curve, so delicate, so adamantine, strong as a mountain cavern, graceful as a bow just bent; when first, before its moon-like circumference was all risen, the gondolier's cry 'Ah, Stalè!' struck sharp upon the ear, and the prow turned aside under the mighty cornices that half met over the narrow canal, where the splash of the water followed close and loud, ringing along the marble by the boat's side; and when at last that boat darted forth upon the breadth of silver sea, across which the front of the ducal palace, flushed with its sanguine veins, looks to the snowy dome of Our Lady of Salvation, it was no marvel that the mind should be so deeply entranced by the visionary charm of a scene so beautiful and so strange, as to forget the darker truths of its history and its being. Well might it seem that such a city had owed her existence rather to the rod of the enchanter than the fear of the fugitive; that the waters which encircled her had been chosen for the mirror of her state rather than the shelter of her nakedness; and that all which in nature was wild and merciless—time and decay, as well as the waves and tempests—had been won to adorn her instead of to destroy, and might still spare, for ages to come, that beauty which seemed to have fixed for its throne the sands of the hour-glass as well as of the sea. And although the last eventful years, fraught with change to

the face of the whole earth, have been more fatal in their influence on Venice than the five hundred that preceded them; though the noble landscape of approach to her can now be seen no more, or seen only by a glance, as the engine slackens its rushing on the iron line; and though many of her palaces are for ever defaced, and many in desecrated ruins, there is still so much of magic in her aspect, that the hurried traveller, who must leave her before the wonder of that first aspect has been worn away, may still be led to forget the humility of her origin, and to shut his eyes to the depth of her desolation. They, at least, are little to be envied in whose hearts the great charities of the imagination lie dead, and for whom the fancy has no power to repress the importunity of painful impressions, or to raise what is ignoble, and disguise what is discordant, in a scene so rich in its remembrances, so surpassing in its beauty.

MISCELLANEOUS EXAMPLES.

- (1) Find the cost of covering with gravel at $7\frac{1}{2}d.$ per square yard, a path 3 ft. wide round the outside of a circular bed whose diameter is 9 ft.
- (2) A square, whose side is 300 ft., has a circular garden within it 400 ft. in diameter; what will it cost to pave the part outside the garden, at 2s. per square yard?
- (3) The interest on a certain sum for 85 days at £4 6s. 8d. per cent. per annum was £3 13s. 3d.; what was the principal?
- (4) If the Three per Cents. are at $92\frac{1}{2}$, at what price should the Four per Cents. be to pay the same interest on a given investment?
- (5) If I gain £10 per cent. by selling tea at 6s. per lb., what do I gain or lose per cent. by selling it at 5s. 10d. per lb.?

THE INFLUENCE OF 'THE TIMES' NEWSPAPER; AND THE INVASION OF THE CRIMEA.

A.D. 1854.

(From the 'Invasion of the Crimea,' by A. Kinglake.)

dis-sem'-i-nate, to spread, to scatter as seed	ac-cel-er-a'-tion, the act of hastening
ap-peal'-lant (n.), one who appeals	hy-per-bo-le, a figure of speech, which represents things as greater or less than they really are
co'-gen-cy, force, strength	au-to-cratic'-io, absolute
ex-po'-nent, index, that which points out	tech'-ni-cal, specially belonging to a profession or art
sen'-ti-ent, having feeling	
per'-ma-nent, durable, lasting	

For a long time there had remained to the general public a vestige of their old custom of thinking for themselves; because in last resort they were privileged to determine between the

rival counsels pressed upon them by contending journalists; but several years before the outbreak of the war there had come yet another change. The apparatus provided by the constitution for collecting the opinions of the people was far from being complete; and, notwithstanding the indications afforded by Parliament and by public writings, the direction which the nation's opinion had taken was a matter which could often be called in question. Some could say that the people desired one thing, and some with equal boldness that the people desired the contrary. Thence it came that the task of finding out the will of the nation, and giving to it a full voice and expression, was undertaken by private citizens.

Long before the outbreak of the war there were living in some of the English counties certain widows and gentlemen, who were the depositaries of a power destined to exercise a great sway over the conduct of the war. Their ways were peaceful, and they were not perhaps more turned towards politics than other widows and country gentlemen, but by force of deeds and testaments, by force of births, deaths, and marriages, they had become the members of an ancient firm or company which made it its business to collect and disseminate news. They had so much good sense of the worldly sort, that instead of struggling with one another for the control of their powerful engine, they remained quietly at their homes, and engaged some active and gifted men to manage the concern for them in London. The practice of the company was to issue a paper daily, containing an account of what was going on in the world, together with letters from men of all sorts and conditions who were seeking to bring their favourite subjects under the eye of the public, and also a few short essays upon the topics of the day. Likewise, upon paying the sum required by the company, any person could cause whatever he chose to be inserted in the paper as an 'advertisement,' and the sheet containing these four descriptions of matter was sold to the public at a low rate.

Extraordinary enterprise was shown by the company in the gathering of intelligence; and during the wars following the French Revolution they caused their despatches from the Continent to reach them so early that they were able to forestall the Government of the day. In other countries the spectacle of a government outdone in this way by private enterprise would have seemed a scandal; but the Englishman liked the thought that he could buy, and bring to his own home, as much knowledge as was in the hands of a Minister of State, and he enjoyed the success of his fellow-countrymen in their rivalry with the Government. From this time the paper gathered strength. It became the foremost journal of the world; and this was no

sooner the case than the mere fact of its being thus foremost gave a great acceleration to its rise, for, simply because it was recognised as the most public of prints, it became the clue with which anxious man went seeking in the maze of the busy world for the lost, and the unknown, and all that was beyond his own reach. The prince who was claiming a kingdom, the servant who wanted a place, the mother who had lost her boy, they all went thither. Thither Folly ran hurrying, and was brought to a wholesome parley with Wisdom. Thither went righteous Anger. Thither also went Hatred and Malice. And not in vain was all this concourse; for either the troubled and angry men got the discipline of finding that the world would not listen to their cries, or else they gained a vent for their passions, and brought all their theories to a test by calling a whole nation—nay, by calling the civilised world—to hearken and be their witness. Over all this throng of appellants men unknown sat in judgment, and—violently, perhaps, but never corruptly—a rough sort of justice was done. The style which oriental hyperbole used to give to the Sultan might be claimed with more colour of truth by the journal. In a sense it was the 'asylum of the world.'

Still, up to this point the company occupied ground in common with many other speculators, and if they had gone no further, it would not have been my province to notice the result of their labours. But many years ago it had occurred to the managers of this company that there was one important article of news which had not been effectually supplied. It seemed likely that, without moving from his fireside, an Englishman would be glad to know what the bulk of his fellow-countrymen thought upon the uppermost questions of the day. The letters received from correspondents furnished some means of acquiring this knowledge, and it seemed to the managers of the company, that at some pains and at a moderate cost it would be possible to ascertain the opinions which were coming into vogue, and see the direction in which the current would flow. It is said that with this intent they many years ago employed a shrewd, idle clergyman, who made it his duty to loiter about in places of common resort and find out what people thought upon the principal subjects of the time. He was not to listen very much to extreme foolishness, and still less was he to hearken to clever people. His duty was to wait and wait until he observed that some common and obvious thought was repeated in many places, and by numbers of men who had probably never seen one another. That one common thought was the prize he sought for, and he carried it home to his employers. He became so skilled in his peculiar calling that as long as he served them, the company was rarely misled; and although in

later times they were frequently baffled in their pursuit of this kind of knowledge, they never neglected to do what they could to search the heart of the nation.

When the managers had armed themselves with the knowledge thus gathered, they prepared to disseminate it, but they did not state boldly what they had ascertained to be the opinion of the country. Their method was as follows: they employed able writers to argue in support of the opinion which, as they believed, the country was already adopting, and, supposing that they had been well informed, their arguments of course fell upon willing ears. Those who had already formed a judgment saw their own notions stated and pressed with an ability greater than they could themselves command; and those who had not yet come to an opinion were strongly moved to do so, when they saw the path taken by a company which notoriously strove to follow the changes of the public mind. The report which the paper gave of the opinions formed by the public was so closely blended with arguments in support of that same opinion, that he who looked at the paper merely to know what other people thought, was seized as he read by the cogency of the reasoning; and on the other hand, he who imagined that he was being governed by the force of sheer logic, was merely obeying a guide who, by telling him that the world was already agreed, made him go and flock along with his fellows: for as the utterance of a prophecy is sometimes a main step towards its fulfilment, so a rumour asserting that multitudes have already adopted a given opinion will often generate that very concurrence of thought which was prematurely declared to exist. From the operation of this double process it resulted of course that the opinion of the English public was generally in accord with the writings of the company; and the more the paper came to be regarded as a true exponent of the national mind, the more vast was the publicity which it obtained.

But though the company held all this power, their tenure of it was of such a kind that they could not exercise it perversely or whimsically without doing a great harm to their singular trade; for the whole scheme of their existence went to make them not autocratic, but representative in their character, and they were obliged by the law of their being to keep themselves as closely as they could in accord with the nation at large.

This, then, was the great English journal; and, whether men spoke of the mere printed sheet which lay upon their table, or of the mysterious organisation which produced it, they habitually called either one or the other 'The Times.' Moreover, they often prefixed to the word such adjectives and participles as showed that they regarded the subject of their comments in the

light of a sentient, active being, having a life beyond the span of mortal men, gifted with reason, armed with a cruel strength, endowed with some of the darkest of the human passions, but clearly liable hereafter to the direst penalty of sin. . . .

Of the temper and spirit in which this strange power had been wielded, up to the time of the outbreak of the war, it is not very hard to speak. In general, 'The Times' had been more willing to lead the nation in its tendencies to improvement than to follow it in its errors; what it mainly sought was, not to be much better or wiser than the English people, but to be the very same as they were—to go along with them in all their adventures, whether prudent or rash—to be one with them in their hopes and their despair, in their joy and in their sorrow, in their gratitude and in their anger. So, although in general it was willing enough to repress the growth of any new popular error which seemed to be weakly rooted, still the whole scheme and purpose of the company forbade it all thought of trying to make a stand against any great and general delusion. Upon the whole, the potentate dealt with England in a bluff, kingly, Tudor-like way, but also with a Tudor-like policy, for, though he treated all adversaries as 'brute folk' until they became formidable, he had always been careful to mark the growth of a public sentiment or opinion, and as soon as he was able to make out that a cause was waxing strong, he went up and offered to lead it, and so reigned.

I have said that partly by guiding, but more by ascertaining and following the current of men's opinion, 'The Times' always sought to be one with the great body of the people, and since it happened that there was at this period a rare concurrence of feeling, and that the journal, after a good deal of experiment, had now at length thoroughly seized and embodied the soul of the nation, its utterance came with increasing force; and in proportion as the growing concord of the people enabled it to speak with more and more authority, power lapsed and continued to lapse from out of the hands of the Government, until at length public opinion—no longer content to direct the general policy of the State—was preparing to undertake the almost scientific, the almost technical duty of planning a campaign.

On the morning of June 15, the great newspaper declared and said that 'the grand political and military objects of the war could not be attained as long as Sebastopol and the Russian fleet were in existence, but that if that central position of the Russian power in the south of the empire were annihilated, the whole fabric which it had cost the czars of Russia centuries to raise, must fall to the ground;' and moreover it declared 'that the taking of Sebastopol and the occupation of the Crimea were objects which would repay all the costs of the

war and would permanently settle in our favour the principal questions in dispute, and that it was equally clear that those objects were to be accomplished by no other means, because a peace which should leave Russia in possession of the same means of aggression would only enable her to recommence the war at her pleasure.'

Before the seventh day from the manifesto of the 15th, the country had made loud answer to the appeal, and on June 22, the great newspaper, informed with the deep will of the people, and taking little account of the fears of the prudent and the scruples of the good, laid it down that 'Sebastopol was the keystone of the arch which spanned the Euxine, from the mouths of the Danube to the confines of Mingrelia,' and that 'a successful enterprise against the place was the essential condition of permanent peace.' And although this appeal was founded in part upon a false belief—a belief that the siege of Silistria had been raised—it seemed as though all mankind were making haste to adjust the world to the newspaper, for within twenty hours from the publication of June 22, truth obeyed the voice of false rumours, and followed in the wake of 'The Times.'

Of course there were those who saw great obstacles in the way of the proposed invasion, and they said that since Russia was a first-rate military Power it must be rash to invade her territory, and to besiege her proudest fortress, without first gaining some safe knowledge of the enemy's strength. But the narrative then coming home in fragments from the valley of the Danube was heating the minds of the people in England.†

MISCELLANEOUS EXAMPLES.

- (1) If a warehouse contains goods worth £17,320, and is only insured for 86·3 per cent. of its value, what sum would be lost in case of its destruction by fire?
- (2) What amount of capital is that which, after being employed at 5½ per cent. simple interest for 4 years, becomes £5,000?
- (3) What is the greater loss per cent., 4*d.* on 5*s.* 8*d.*, or 3*d.* on 4*s.* 6*d.*, and by how much?
- (4) A legacy of £100 is left to a child one year old, but is not to be given till he is 21 years old. What will he receive, 4 per cent. compound interest being allowed?

* The siege of Silistria was raised early in the morning of the 23rd.

† Sebastopol, after the battle of the Alma, was invested by the allied armies of France and England, October 7th, 1854. During the siege, the battles of Balaklava, Inkermann, and Tchernaya, with the celebrated 'Charge of the Light Brigade,' took place. Sebastopol was evacuated by the Russians, after they had destroyed their defences and military stores. The allied army entered the town September 9th, 1855. Peace was concluded with Russia 27th April, 1856.

THE GOLDEN DUSTMAN ENGAGES A SECRETARY.

(From 'Our Mutual Friend,' by Charles Dickens.)

com-ply-ca'-tion, a mixture of many things
 ci-vil'-i-an, one who is not a soldier
 man-œu'-vre (v.), to manage skilfully, to change the position of troops or ships
 le'-gi-bile, that can be easily read
 ap-pre'-ci-a-ble, that can be valued or estimated
 ster'-tor-ous, snorting or snoring; loud breathing
 re-lin'-quish, to leave, to let go
 dex'-ter-ous, skilful, handy

dock'-et, to mark on the outside of a packet an indication of its contents
 re-jec'-tion, refusal
 post-poned, to put off
 in-dec'-i-sive, not decided
 in-ge-nu'-i-ty, skill
 ap'-o-plex-y, a fit, in which the patient is suddenly deprived of sense and motion
 a-chieve'-ment, something done
 re-cite', to repeat from memory

[Mr. Nicodemus Boffin, the 'Golden Dustman,' has inherited a very large fortune, and being, although entirely uneducated, of an inquiring turn of mind, has engaged as 'literary man,' one Silas Wegg, a man 'with a wooden leg,' to read to him of an evening. Silas keeps a ballad stall in the day-time near 'the aristocratic mansion' in which he takes so much interest. Rokesmith, for purposes of his own, offers his services to Mr. Boffin as private secretary.]

MR. AND MRS. BOFFIN sat after breakfast in the 'bower,' a prey to prosperity. Mr. Boffin's face denoted care and complication. Many disordered papers were before him, and he looked at them about as hopefully as an innocent civilian might look at a crowd of troops whom he was required at five minutes' notice to manoeuvre and review. He had been engaged in some attempts to make notes of these papers; but being troubled (as men of his stamp often are) with an exceedingly distrustful and corrective thumb, that busy member had so often interposed to smear his notes, that they were little more legible than the various impressions of itself which blurred his nose and forehead. It is curious to consider, in such a case as Mr. Boffin's, what a cheap article ink is, and how far it may be made to go. As a grain of musk will scent a drawer for many years, and still lose nothing appreciable of its original weight, so a halfpenny-worth of ink would blot Mr. Boffin to the roots of his hair and the calves of his legs, without inscribing a line on the paper before him, or appearing to diminish in the inkstand.

Mr. Boffin was in such severe literary difficulties that his eyes were prominent and fixed, and his breathing was stertorous, when, to the great relief of Mrs. Boffin, who observed these symptoms with alarm, the yard bell rang.

'Who's that, I wonder?' said Mrs. Boffin.

Mr. Boffin drew a long breath, laid down his pen, looked at his notes, as doubting whether he had the pleasure of their ac-

quaintance, and appeared, on a second perusal of their countenances, to be confirmed in his impression that he had not, when there was announced by the hammer-headed young man—

‘Mr. Rokesmith.’

‘Oh!’ said Mr. Boffin. ‘Oh, indeed! Our and the Wilfers’ Mutual Friend, my dear. Yes. Ask him to come in.’

Mr. Rokesmith appeared.

‘Sit down, sir,’ said Mr. Boffin, shaking hands with him. ‘Mrs. Boffin you’re already acquainted with. Well, sir, I am rather unprepared to see you, for, to tell you the truth, I’ve been so busy with one thing and another, that I’ve not had time to turn your offer over.’

‘That’s apology for both of us: for Mr. Boffin and for me as well,’ said the smiling Mrs. Boffin. ‘But lor! we can talk it over now; can’t us?’

Mr. Rokesmith bowed, thanked her, and said he hoped so.

‘Let me see then,’ resumed Mr. Boffin, with his hand to his chin. ‘It was secretary that you named; wasn’t it?’

‘I said secretary,’ assented Mr. Rokesmith.

‘It rather puzzled me at the time,’ said Mr. Boffin, ‘and it rather puzzled me and Mrs. Boffin when we spoke of it afterwards, because (not to make a mystery of our belief) we have always believed a secretary to be a piece of furniture, mostly of mahogany, lined with green baize or leather, with a lot of little drawers in it. Now, you won’t think I take a liberty when I mention that you certainly aint *that*.’

‘Certainly not,’ said Mr. Rokesmith; ‘but he had used the word in the sense of steward.’

‘Why, as to steward, you see,’ returned Mr. Boffin, with his hand still to his chin, ‘the odds are that Mrs. Boffin and me may never go upon the water. Being both bad sailors, we should want a steward if we did; but there’s generally one provided.’

Mr. Rokesmith again explained; defining the duties he sought to undertake, as those of general superintendent, or manager, or overlooker, or man of business.

‘Now, for instance—come!’ said Mr. Boffin, in his pouncing way. ‘If you entered my employment, what would you do?’

‘I would keep exact accounts of all the expenditure you sanctioned, Mr. Boffin. I would write your letters, under your direction. I would transact your business with people in your pay or employment. I would,’ with a glance and a half-smile at the table, ‘arrange your papers—’

Mr. Boffin rubbed his inky ear, and looked at his wife.

‘—And so arrange them as to have them always in order for immediate reference, with a note of the contents of each outside it.’

'I tell you what,' said Mr. Boffin, slowly crumpling his own blotted notes in his hand; 'if you'll turn to at these present papers, and see what you can make of 'em, I shall know better what I can make of you.'

No sooner said than done. Relinquishing his hat and gloves, Mr. Rokesmith sat down quietly at the table, arranged the open papers into an orderly heap, cast his eyes over each in succession, folded it, docketed it on the outside, laid it in a second heap, and, when that second heap was complete, and the first gone, took from his pocket a piece of string and tied it together with a remarkably dexterous hand at a running curve and a loop.

'Good!' said Mr. Boffin. 'Very good! Now let us hear what they're all about; will you be so good?'

John Rokesmith read his abstracts aloud. They were all about the new house. Decorator's estimate, so much. Furniture estimate, so much. Estimate for furniture of offices, so much. Coachmaker's estimate, so much. Horsedealer's estimate, so much. Harnessmaker's estimate, so much. Goldsmith's estimate, so much. Total, so very much. Then came correspondence. Acceptance of Mr. Boffin's offer of such a date, and to such an effect. Rejection of Mr. Boffin's proposal of such a date, and to such an effect. Concerning Mr. Boffin's scheme of such another date, to such another effect. All compact and methodical.

'Apple-pie order!' said Mr. Boffin, after checking off each inscription with his hand, like a man beating time. 'And whatever you do with your ink, I can't think, for you're as clean as a whistle after it. Now, as to a letter,' said Mr. Boffin, rubbing his hands in his pleasantly childish admiration, 'let's try a letter next.'

'To whom shall it be addressed, Mr. Boffin?'

'Anyone. Yourself.'

Mr. Rokesmith quickly wrote and then read aloud:—

'Mr. Boffin presents his compliments to Mr. John Rokesmith, and begs to say that he has decided on giving Mr. John Rokesmith a trial in the capacity he desires to fill. Mr. Boffin takes Mr. John Rokesmith at his word, in postponing to some indefinite period the consideration of salary. It is quite understood that Mr. Boffin is in no way committed on that point. Mr. Boffin has merely to add, that he relies on Mr. John Rokesmith's assurance that he will be faithful and serviceable. Mr. John Rokesmith will please enter on his duties immediately.'

'Well, now, Noddy!' cried Mrs. Boffin, clapping her hands, 'that is a good one!'

Mr. Boffin was no less delighted; indeed, in his own house

he regarded both the composition itself, and the device that had given birth to it, as a very remarkable monument of human ingenuity.

'And I tell you, my deary,' said Mrs. Boffin, 'that if you don't close with Mr. Rokesmith now at once, and if you ever go a-muddling yourself again with things never meant nor made for you, you'll have an apoplexy—besides iron-moulding your linen—and you'll break my heart.'

Mr. Boffin embraced his spouse for these words of wisdom, and then congratulating John Rokesmith on the brilliancy of his achievements, gave him his hand in pledge of their new relations. So did Mrs. Boffin.

'Now,' said Mr. Boffin, who, in his frankness, felt that it did not become him to have a gentleman in his employment five minutes, without reposing some confidence in him, 'you must be let a little more into our affairs, Rokesmith. I mentioned to you, when I made your acquaintance, or I might better say, when you made mine, that Mrs. Boffin's inclination was setting in the way of fashion, but that I did not know how fashionable we might or might not grow. Well! Mrs. Boffin has carried the day, and we're going in neck and crop for fashion.'

'I rather inferred that, sir, replied John Rokesmith, 'from the scale on which your new establishment is to be maintained.'

'Yes,' said Mr. Boffin, 'it's to be a spanker. The fact is, my literary man named to me that a house with which he is, as I may say, connected—in which he has an interest——'

'As property?' inquired John Rokesmith.

'Why, no,' said Mr. Boffin, 'not exactly that; a sort of family tie.'

'Association?' the secretary suggested.

'Ah!' said Mr. Boffin. 'Perhaps. Anyhow, he named to me that the house had a board up, "This Eminently Aristocratic Mansion to be Let or Sold." Me and Mrs. Boffin went to look at it, and finding it beyond a doubt eminently aristocratic (though a trifle high and dull, which after all may be part of the same thing), took it. My literary man was so friendly as to drop into a charming piece of poetry on that occasion, in which he complimented Mrs. Boffin on coming into possession of—How did it go, my dear?'

Mrs. Boffin replied:—

'The gay, the gay and festive scene,
The halls, the halls of dazzling light.'

'That's it! And it was made neater by there really being two halls in the house, a front 'un and a back 'un, besides the

servants'. He likewise dropped into a very pretty piece of poetry, to be sure, respecting the extent to which he would be willing to put himself out of the way to bring Mrs. Boffin round, in case she should ever get low in her spirits in the house. Mrs. Boffin has a wonderful memory. Will you repeat it, my dear ?'

Mrs. Boffin complied, by reciting the verses in which this obliging offer had been made, exactly as she had received them :—

'I'll tell thee how the maiden wept, Mrs. Boffin,
When her true love was slain, ma'am,
And how her broken spirit slept, Mrs. Boffin,
And never woke again, ma'am.
I'll tell thee (if agreeable to Mr. Boffin) how the
 Steed drew nigh,
And left his lord afar ;
And if my tale (which I hope Mr. Boffin might excuse)
 Should make you sigh,
I'll strike the light guitar.'

'Correct to the letter !' said Mr. Boffin. 'And I consider that the poetry brings us both in, in a beautiful manner.'

The effect of the poem on the secretary being evidently to astonish him, Mr. Boffin was confirmed in his high opinion of it, and was greatly pleased.

MISCELLANEOUS EXERCISES.

- (1) What is the area of a circular lake which takes me $2\frac{1}{2}$ hours to walk round it at the rate of $3\frac{1}{4}$ miles an hour ?
- (2) What is the value of a square bar of gold one foot in length, and $1\frac{1}{2}$ in. in breadth and thickness, a cubic inch weighing 131 oz., and the price being £3 17s. 6d. per oz. ?
- (3) If the bore of a supply-pipe be 12 square inches, at what rate must water pass through it in order to provide 30,000 cubic feet every 24 hours ?
- (4) How many paving stones, each 18 inches long and 10 inches wide, will be required to floor a rectangular hall, 75 ft. by 60 ft. ; and what would it cost at 1s. 3d. per square foot ?
- (5) There is a circular flower-bed whose diameter is 27 feet ; what would be the cost of planting both sides of the path around it with box, at 9d. per yard, the width of the path being 4 ft. 6 in. ?
- (6) A cistern is 6 ft. long, 3 ft. 9 in. wide, and 4 ft. deep. The supply-pipe is 4 inches in circumference, the discharge-pipe 3 inches. If the water be drawn off as soon as it commences to flow in, what time will be required to fill it, supposing it to have been empty at first ; the rate of the supply being 100 ft. per minute, and that of the exit 40 ?

RULES OF ARITHMETIC.

SIMPLE PROPORTION.—Of the three terms given, consider which is the one of the same kind as that in which the answer, or fourth term, is required to be. Place this term in the third place. Of the remaining two terms, consider whether the answer required will be less or greater than the third term. If greater, place the larger of the two remaining terms in the second place; if less, place the smaller of these terms in the second place. Put the remaining term in the first place. Reduce the first and second terms to the same denomination. Multiply the second and third terms together, and divide the product by the first. The quotient will be the answer required.

COMPOUND PROPORTION.—Find the quantity which is of the same kind as that in which the answer is to be. Place this in the third term. Of the remaining terms, take the pairs that are alike in kind, and deal with them according to the rule of *Simple Proportion*, placing the larger or smaller term in the second place and the remainder in the third, according as the answer required is to be greater or less than the third term. Arrange the different ratios one under the other. Reduce the first and second terms to like denominations. Multiply all the first together for a new first term, and all the second terms for a new second term. Proceed as in *Simple Proportion*, i.e. multiply the second and third terms together; divide the product by the first term, and the quotient will be the answer.

TO FIND THE GREATEST COMMON MEASURE OF TWO NUMBERS.—Divide the greater by the less, and the former divisor by the remainder; and so on until there is no remainder. The last divisor is the greatest common measure required.

TO REDUCE A FRACTION TO ITS LOWEST TERMS.—Divide both the numerator and the denominator by their greatest common measure. In its new form the fraction will be in its lowest terms, *in which all answers must be given.*

TO FIND THE LEAST COMMON MULTIPLE OF TWO OR MORE NUMBERS.—If the least common multiple of two numbers only be required, divide each by the greatest common measure, and multiply the quotients and this divisor together. The product thus obtained will be the least common multiple required. If more than two numbers are given, set them in a line, and strike out such of them as are contained in any of the others. Then divide as many as possible of the remaining numbers by

the highest number common to them. Treat the new line thus formed in the same way, and proceed thus until no common measure can be found. Multiply all the numbers of the last line and all the divisors together, and the product will be the least common multiple required.

TO REDUCE FRACTIONS TO A COMMON DENOMINATOR.—Find the least common multiple of the denominators. Divide it by each denominator, and multiply each quotient by the corresponding numerator of each fraction. The products thus obtained will be the new numerators, of which the least common multiple of the denominators is the common denominator.

TO REDUCE A MIXED NUMBER TO AN IMPROPER FRACTION.—Multiply the whole number by the denominator of the fraction; add to the product the numerator of the fraction, and place the denominator under the sum.

TO REDUCE AN IMPROPER FRACTION TO A WHOLE OR MIXED NUMBER.—Divide the numerator by the denominator. The quotient will be the whole number, and the remainder, if any, will be the numerator of the fraction.

TO MULTIPLY A FRACTION BY A WHOLE NUMBER.—Multiply the numerator or divide the denominator of the fraction by the whole number.

TO DIVIDE A FRACTION BY A WHOLE NUMBER.—Divide the numerator or multiply the denominator of the fraction by the whole number.

ADDITION OF FRACTIONS.—Proceed exactly as in reducing to a common denominator. Then add all the numerators together, and place the common denominator under the sum.

SUBTRACTION OF FRACTIONS.—If the denominators of the fractions are the same, find the difference between the numerators. If the denominators are different, reduce the fractions to a common denominator. Subtract the less numerator from the greater, and place the common denominator under the remainder.

MULTIPLICATION OF FRACTIONS.—Multiply the numerators together for a new numerator, and the denominators together for a new denominator.

DIVISION OF FRACTIONS.—Invert the divisor, and proceed as in multiplication.

TO FIND THE VALUE OF A FRACTION WHEN THE VALUE OF THE WHOLE QUANTITY IS GIVEN.—Multiply the quantity by the numerator, and divide the product by the denominator.

TO REDUCE VULGAR FRACTIONS TO OTHERS OF DIFFERENT

DENOMINATIONS.—When the fraction is to be altered to one of a *higher* name, multiply the *denominator* by as many of the less as make up one of the greater; but when the fraction is to be altered to an equivalent fraction of a *lower* name, multiply the *numerator* by as many of the lower name as make up one of the higher.

ADDITION OF DECIMAL FRACTIONS.—Place the figures as in Simple Addition, and so arrange them that the decimal point of each succeeding amount shall come immediately below the previous one. Add up exactly as in Simple Addition, placing a decimal point in the answer immediately underneath the other decimal points.

SUBTRACTION OF DECIMAL FRACTIONS.—Arrange as in addition. Subtract as in Simple Subtraction, placing a decimal point in the answer underneath the other two.

MULTIPLICATION OF DECIMAL FRACTIONS.—Multiply as in whole numbers. Mark off in the product, as many places of decimals as there are decimals in the multiplicand and multiplier together.

DIVISION OF DECIMAL FRACTIONS.—Case I. *When the divisor is a whole number.* Divide by the whole number. Place the first figure of the quotient in the same decimal place as the figure of the dividend from which it was obtained. Add ciphers to the remainder, and continue the process as long as may be necessary.

Case II. *When the dividend has a greater number of decimal places than the divisor.* Divide as in whole numbers. Mark off in the quotient as many decimal places as the dividend contains more than the divisor. Add ciphers to the remainder and carry the answer to any place of decimals required.

Case III. *When the divisor has a greater number of decimal places than the dividend.* Add to the dividend as many ciphers as will make the number of decimals in it equal to the number in the divisor. Divide, and the quotient will represent whole numbers. Should there be a remainder, add ciphers to it and divide. The figures obtained after the addition of ciphers to the remainder will be decimals.

TO REDUCE A CIRCULATING DECIMAL TO A VULGAR FRACTION.—Case I. *When the circulating decimals are pure, i.e. when they are repeated from the beginning.* Make the repeated decimals the numerator of a fraction, the denominator of which will be as many nines as there are figures in the circulating decimal. This fraction reduced to its lowest terms, will be the fraction required.

CASE II. *When the circulating decimals are mixed, i.e. when only part of the decimals are repeated.* Subtract the figures which do not circulate from the whole number of decimals, including only the first period of the circulating part. The remainder will be the numerator of the fraction, the denominator of which will be as many nines as there are figures in the circulating part, and as many ciphers, placed on the right of the nines, as there are figures in the non-circulating part (e.g. $14 = 14 - 1 = \frac{13}{99}$).

TO REDUCE A QUANTITY TO A DECIMAL OF A LOWER DENOMINATION.—Multiply by as many of the less as make one of the greater. Point off, in the answer, as many decimal places as there are in the multiplicand.

TO FIND THE EQUIVALENT VALUE TO A GIVEN DECIMAL IN ORDINARY CONCRETE NUMBERS.—Reduce the fractional part of the expression as above, reserving the whole number as part of the answer. Continue to reduce the fractions remaining until the lowest denomination is reached. The series of whole numbers will form the answer.

TO REDUCE A QUANTITY TO A DECIMAL OF A HIGHER DENOMINATION.—Divide the decimal, step by step, by as many of the less as make one of the greater, until the required denomination is reached.

WHEN A CONCRETE NUMBER IS GIVEN IN THE ORDINARY FORM, TO EXPRESS IT DECIMALLY.—Begin with the quantity of the lowest denomination named. Divide this by as many of the less as make one of the next higher in name. Add the whole number of this higher name to the fraction thus found, and divide again so as to reduce this to the denomination next above. Continue to divide and to add in the whole numbers one by one, until the required denomination is reached.

DECIMAL COINAGE. **TO REDUCE ANY SUM OF MONEY TO A DECIMAL FORM, WHICH SHALL BE TRUE TO THE THIRD PLACE.**—Take the pounds as whole numbers, and fill up the three places of decimals as follows:—100 for every two shillings; 50 for every shilling; 25 for sixpence; and 1 for every additional farthing.

TO CHANGE A DECIMAL EXPRESSION INTO THE ORDINARY ONE.—Take two shillings for every 1 in the first decimal place, one shilling for every 5 in the second place, and a farthing for each of the remaining figures to the third place; unless the number be 25 or over, in which case omit one farthing from the answer.

TARE AND TRET.

TARE is an allowance made by merchants to their customers for the weight of the packages which contain the goods sold.

GROSS WEIGHT is the whole weight including packages, &c.

NET WEIGHT is the weight after all the allowances have been deducted.

SUTTLE is that which remains when part of the allowance is taken from the gross weight.

Subtract the tare from the gross; the remainder is called the *suttle*, and, if no other allowance be made, it is the *net weight*.

TRET is an allowance of 4 lbs. in every 104 lbs., i.e. $\frac{1}{4}$ th of the *suttle*, for waste, dust, &c., which, subtracted from the *suttle*, leaves the *tret suttle*.

CLOFF is an allowance of 2 lbs. in every 3 cwt. for waste *suttle*, waste, dust, &c., to the retailer. To find it, multiply the cwt. in the *tret suttle* by 2 and divide by 3: the quotient will be the *clloff* in lbs., which must be deducted as before.

The values in money are usually found by **PRACTICE**.

INSURANCE, COMMISSION, ETC.

INSURANCE is money paid for protection from loss by fire, &c. &c.

COMMISSION is money paid to an agent for his trouble in buying or selling property.

BROKERAGE is money paid to a stock or share broker for buying or selling stock in the public funds, shares in companies, &c. &c.

PER CENT. means per hundred, usually per 100.

PREMIUM is the money paid, yearly or otherwise, for insurance.

A **POLICY OF INSURANCE** is the writing which the insurer receives from the insurance office as an acknowledgment that he has insured his property, and an agreement on the part of the company to protect him from loss by fire, &c., to the amount for which he insures.

RULE:—Multiply the amount by the rate per cent., divide the product by 100; the quotient is the Insurance, Commission, or Brokerage required.

STOCKS AND SHARES.

STOCK generally, is money in the public funds, i.e. lent to the government, on which interest is paid at a certain rate per cent., according to agreement when the money is invested. 100% *Stock* is worth sometimes more, at others less, than 100%.

according to the state of the money market. When it is worth exactly 100*l.*, it is said to be *at par*; when less, *below par*; and when more, *above par*. CONSOLS are sums of money in government securities.

SHARES in public companies are of various amounts, but always the same for the same company. When worth more than the original amount they are said to be at a *premium*; when less, at a *discount*.

To find the cost of stock.

RULE:—Multiply by the amount per cent. paid for it and divide by 100; the quotient is the answer.

SIMPLE INTEREST.

INTEREST is money paid for the use of money.

THE RATE PER CENT. PER ANNUM is the money paid every year for the use of 100*l.*

THE PRINCIPAL is the money lent.

THE AMOUNT is the principal and interest added together.

SIMPLE INTEREST is interest paid on the principal every year, without adding to it the interest which may accumulate.

To find the Simple Interest for one or more years.

RULE:—Multiply the principal by the rate per cent., and divide by 100: the quotient is the interest for one year. Multiply this by the given number of years.

NOTE:—It is sometimes convenient to multiply by both the rate per cent. and the time before dividing by 100.

To find the Simple Interest for months, weeks, and days.

RULE:—If the time forms an aliquot part of a year, multiply the interest for one year by that aliquot part. If not, reduce the odd months, weeks, and days, to days, and work by proportion. Say, As 365 days is to the number of days, so is one year's interest to the interest required. The years, if any, must be calculated separately, so may the months.

COMPOUND INTEREST.

When the interest of any sum of money is added to the principal at certain periods, and interest afterwards calculated on the whole amount, the principal is said to be at compound interest.

RULE:—Find the interest for one year. Add this to the principal. Find the interest on this amount for the second year.

Add this to the second year's principal. Find the interest on this amount for the third year. Proceed in this manner for the number of years given. And lastly, for any fractional part of a year. Subtract the principal from the last *amount*, and the remainder will be the compound interest required.

When the number of years is considerable, the above method is a very long and difficult one. In such case, the following formula may be advantageously employed :—

Let M = the amount.

n = the number of years

P = the principal

r = the rate per cent.

Then $M = P \left(1 + \frac{r}{100}\right)^n$

If I = the compound interest for n years, then $I = M - P$.

NOTE :—The limits of this work will not admit of the proof for this formula being given, simple as it is, nor will it allow of an explanation of logarithmic tables by which the labour may be considerably lessened. These must be left to the teacher.

BANKER'S DISCOUNT.

DISCOUNT is an allowance for the payment of money before it becomes due.

TO FIND THE PRESENT VALUE OF A BILL.

RULE :—Find the interest on the amount of the bill for the given time at the given rate per cent. This will be the discount, which, deducted from the debt, leaves the present value.

TRUE DISCOUNT.

The *true* present value of a bill due at any given time is such a sum as would, at the given rate per cent. for the given time, amount to the sum mentioned on the bill.

TO FIND THE TRUE PRESENT VALUE OF A BILL.

RULE :—By proportion. Say, *As* 100% plus its interest for the given time *is to* the debt, *so is* that interest *to* the true discount, which, deducted from the debt, leaves the present value.

PARTNERSHIP WITHOUT TIME.

RULE :—By proportion. Say, *As* the whole stock *is to* the whole gain or loss, *so is* each man's stock *to* his share of the gain or loss.

PARTNERSHIP WITH TIME.

RULE:—Multiply each man's money by his time, add these sums together for the whole stock, and proceed as in the preceding rule.

NOTE:—The former of these two rules is sometimes called 'Single Fellowship,' the latter, 'Double Fellowship.'

INVOLUTION.

The square of a number, or its second power, is the product of that number when multiplied *once* by itself.

The cube of a number, or its third power, is the product of the number when multiplied *twice* by itself.

The fourth power, is when the number is multiplied *three times* by itself, and so on.

The power to which the number is to be raised is sometimes indicated by a small figure placed a little to the right, above the number. This small figure is called the index. Thus 15^4 means 15 raised to the fourth power.

EVOLUTION TO THE SECOND POWER, OR SQUARE ROOT,

Is the finding a number which, when squared, will produce the given number.

RULE:—Place a point over every alternate figure, beginning with that in the unit's place. This will divide the line into *periods* of two figures each. Place the root whose square most nearly approximates to the first period in the quotient. Place the square of this number under the first period. Subtract. Bring down the next period to the remainder. This will form a new dividend. Double the figure in the quotient for a divisor. Find how many times it is contained in the dividend when the unit figure of the latter is omitted. Place the figure representing the number of times in the quotient, and place it also as the unit figure in the divisor. Multiply this divisor by the figure last placed in the quotient. Place the product under the dividend. Subtract. Bring down the next period. Proceed as before till all the periods have been brought down. The quotient is the root required.

The square root of a vulgar fraction is found by taking the square root of its numerator for a new numerator, and the square root of its denominator for a new denominator. This new fraction will be the square root required. Or, reduce the vulgar fraction to a decimal and extract its square root.

NOTE:—Mixed numbers must be reduced to improper fractions or decimals.

In pointing decimals for the square root the first point must be placed on the second figure to the *right of the decimal point*, and on the others alternately. The root is then found by the method above given. As many periods of ciphers may be brought down to the last remainder as is convenient. The farther the operation is extended in this way, the more correct will be the answer.

EVOLUTION TO THE THIRD POWER, OR CUBE ROOT,

Is the finding of a number which, when raised to the third power, or cubed, will produce the given number.

RULE:—Mark a point over every third figure, commencing at the unit figure. Place the nearest cube root of the first period in the quotient. Place its cube under the first period. Subtract. Bring down to the remainder the next period of three figures. Square the quotient and multiply the result by 300 for a divisor. Find how often it is contained in the dividend. Place the number in the quotient. Multiply the divisor by this number. Add to the product the amount of all the figures in the quotient multiplied by 30 except the last, and that product by the square of the last. Add to this the cube of the last figure in the quotient. Subtract the whole from the dividend. Bring down the next period and proceed as before. The quotient will be the cube root required.

The cube root of a vulgar fraction is found by extracting the cube root of its numerator for a new numerator, and the cube root of its denominator for a new denominator.

Or reduce the vulgar fraction to a decimal and proceed as above. Mixed numbers must be reduced to improper fractions or decimals.

DUODECIMALS

Is a system of notation in which each figure is 12 times the value of a similar figure next to it on the right hand. In superficial measure the first figure on the left hand represents square feet; the next to the right, twelfths of a square foot; the next to it square inches (i.e. twelfths of a twelfth of a square foot); the next twelfths of a square inch, and so on. They are usually marked thus: 5 sq. ft., 7', 8", 11'", 10''''.

Square or superficial measure is the result of two measures of length, multiplied together. Cubic, or solid measure, is the result of three measures of length multiplied together.

RULE:—Arrange the figures as in addition. Multiply by each term of the multiplier in succession, placing the results under one another. Add, and the amount will be the answer required. The following should be committed to memory:—

Feet multiplied by feet give square feet.

Feet multiplied by inches give superficial *primes* or twelfths of a square foot ($'$).

Inches multiplied by inches give square inches or superficial seconds ($''$).

Inches multiplied by seconds give twelfths of a square inch or superficial thirds ($'''$).

Feet multiplied by seconds give square inches or superficial seconds ($''$).

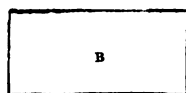
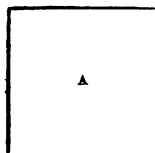
Seconds multiplied by seconds give 144ths of a square inch or superficial fourths ($''''$).

Inches multiplied by thirds give 144ths of a square inch or superficial fourths ($''''$).

WHEN THREE DIMENSIONS have to be multiplied together it will be found convenient to reduce each to the lowest term mentioned in any of them, then multiply. The result will be cubic inches, seconds, &c. as the case may be.

MENSURATION.

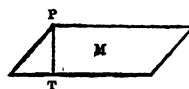
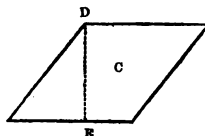
Definitions:—A square is a four-sided figure, having all its sides equal, and all its angles right-angles; as A.



A rectangle is any four-sided figure which has its opposite sides parallel, and all its angles right-angles; as B.

A rhombus is a four-sided figure which has all its sides equal, and its opposite sides parallel, but whose angles are not right-angles, as C.

NOTE:—The line which joins its opposite sides, and is at right-angles to them, is called its perpendicular height; as D E.



The side upon which this perpendicular falls is called the base.

A rhomboid is a four-sided figure which has its opposite sides equal and parallel, but its angles are not right-angles, and its length exceeds its breadth; as M. P T is the perpendicular.

To find the area of a rectangle.

RULE:—Multiply the length by the breadth; the product is the area of the rectangle.

To find the area of a square.

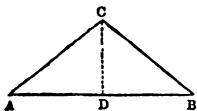
RULE:—Multiply the length of the side by itself; the product is the area of the square.

To find the area of a rhombus or rhomboid.

RULE:—Multiply the length of the base by the perpendicular height, and the product is the area required.

TRIANGLES.

Definition:—A triangle is a plane figure bounded by three straight lines, as CAB .



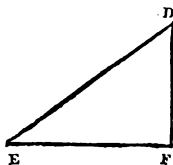
The straight line drawn from any one of its angles C to the opposite side AB , and at right-angles to it, is called the perpendicular (as CD), and the line AB is called the base of the triangle.

To find the area of a triangle when the base and perpendicular are given.

RULE:—Multiply the base by the perpendicular height, and divide the product by two for the area.

THE RIGHT-ANGLED TRIANGLE.

Definition:—A right-angled triangle is one which contains a right-angle, as DEF , where DFE is the right-angle.



The hypotenuse of a right-angled triangle is the side which subtends, or is opposite to, the right-angle, as DE . Here DF is the perpendicular, EF is the base.

To find the hypotenuse of a right-angled triangle.

RULE:—To the square of the perpendicular add the square of the base, and the square root of the product is the hypotenuse required.

To find the area of any triangle when the three sides only are given.

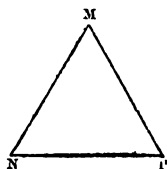
RULE:—From half the sum of the three sides subtract each side separately, then multiply the half sum and the three remainders together. The square root of the product is the area of the triangle.

THE EQUILATERAL TRIANGLE.

Definition:—An equilateral triangle is one which has all its sides equal, as MNP .

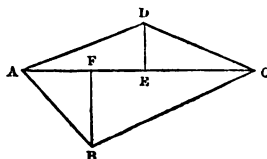
To find the area of an equilateral triangle.

RULE:—Multiply the fourth part of the square of the side by the square root of 3 for the area.



THE TRAPEZIUM.

Definition:—A trapezium is a figure contained by four straight lines, no two of which are parallel to each other, as $ABCD$; where AC is the diagonal, and DE , BF perpendiculars to it.

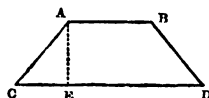


To find the area of a trapezium.

RULE:—Divide the trapezium into two triangles by joining two of its opposite angles; find the area of each triangle, and the sum of both areas will give the area of the trapezium.

THE TRAPEZOID.

Definition:—A trapezoid is a four-sided figure which has only two of its opposite sides parallel, as $ABDC$. AE is the perpendicular.

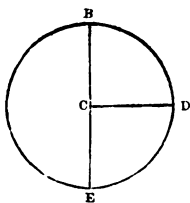


To find the area of a trapezoid.

RULE:—Multiply half the sum of the parallel sides by the perpendicular distance between them; the product is the area.

THE CIRCLE

Definition :—A circle is a plane figure bounded by one line called the circumference, and is such that all straight lines drawn from a certain point within the circle to the circumference are equal to one another. This point is called the centre of the circle.



NOTE :—If c be the centre of the circle, c d is called a radius, and b e a diameter of the circle—c b, c e are also radii.

From the diameter of a circle to find the circumference.

RULE :—Say, As 7 : 22 :: diameter : circumference :
or, as 1 : 3.1416 :: diameter : circumference.

To find the area of a circle.

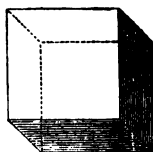
RULE :—Multiply half the circumference by half the diameter for the area.

Or, multiply the square of the diameter by .7854 for the area.

Or, multiply the square of the circumference by .07958 for the area.

THE CUBE.

A cube is a solid having six equal sides at right-angles to one another.

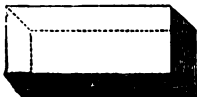


To find the solid content of a cube.

RULE :—Multiply the length of the side twice by itself; the product is the solid content of the cube.

THE PARALLELOPIPEDON.

Definition :—A parallelopipedon is a solid having six rectangular sides, every opposite pair of which are equal and parallel.



To find the solid content of a parallelepipedon.

RULE:—Multiply the length, breadth, and depth together; the product will be the solidity.

THE CYLINDER.

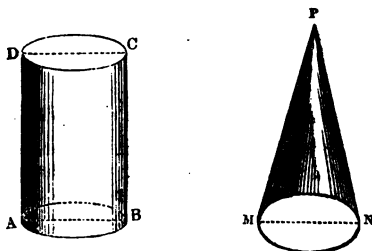
Definition:—A cylinder is a round solid, having circular ends, as A B C D (see below).

To find the convex surface of a cylinder.

RULE:—Multiply the circumference of the cylinder by its perpendicular height for the area of its convex surface.

To find the solid content of a cylinder.

RULE:—Multiply the area of the base by the height of the cylinder, and the product will be its solid content.

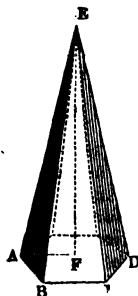


THE RIGHT CONE.

Definition:—A right cone is a solid figure described by the revolution of a right-angled triangle about one of the sides containing the right-angle, which side remains fixed. The base of a cone is a circle. See fig. M N P above.

THE PYRAMID.

Definition:—A pyramid is a solid having a plane figure for its base; and whose sides are triangles meeting in a point, called the vertex. When the base is a triangle, the solid is called a triangular pyramid; when the base is a square, it is called a square pyramid, and so on.



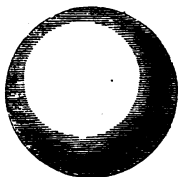
To find the convex surface of a right cone or pyramid.

RULE:—Multiply the circumference of the base by the slant height or length of the side of the cone or pyramid, and half the product will be the surface required. And if this be added to the area of the base, it will give the whole surface.

To find the solidity of a cone or pyramid.

RULE:—Multiply the area of the base by the perpendicular height of the cone or pyramid, and one-third of the product will be the solidity.

THE SPHERE.



Definition:—A sphere is a solid figure described by the revolution of a semi-circle about its diameter which remains unmoved.

To find the convex surface of a sphere.

RULE:—Multiply the diameter of the sphere by its circumference, or 3.1416 by the square of the diameter, and the product will be the convex superficies required.

To find the solid content of a sphere.

RULE:—Multiply the cube of the diameter by .5236 (which is one-sixth of 3.1416), and the product will be the solidity.

BRICKLAYER'S WORK MEASURED BY THE ROD.

Bricklayers always estimate their work at a brick-and-a-half or three half bricks thick, which is called standard measure.

To find the number of rods in a piece of brickwork.

RULE:—Multiply the length and height of the wall in feet together, and this product by the number of half bricks in the thickness of it. Divide the result by 3. This will give the standard measure.

Now a square rod is $30\frac{1}{4}$ yards or $272\frac{1}{4}$ square feet. Therefore if the standard measure in feet be divided by $272\frac{1}{4}$, the quotient will be the number of rods required.

NOTE:—The $\frac{1}{4}$ is usually rejected in favour of the workmen.

ROOFING AND SLATING.

In roofing and slating it is usual to take one-and-a-half times the width of the house within the walls as the measure of the roof when it is a 'true pitch,' i.e. when each rafter is three-fourths of the width of the house. If the roof be not of the true pitch it is measured by a string passed over it or otherwise.

SPECIFIC GRAVITY

Is the weight of any body compared with that of an equal volume of water. The weight of a cubic foot of water is 1,000 ounces avoirdupois. Therefore when we say that the specific gravity of iron is 7.788; we mean that it weighs so many times an equal volume of water, i.e. 7,788 ounces. We may thus estimate the weight of bodies which it would be impossible actually to weigh. A cubic foot of water is 62.5 lbs. av. A gallon of water is generally said to weigh 10 lbs., and contains 277.274 cubic inches.

ANSWERS

TO THE EXAMPLES IN ARITHMETIC

IN THE ADVANCED LESSON BOOK.

PAGE 5.

- (1) £50
- (2) £253 6s. 8d.
- (3) £13 3s. 4½d.
- (4) £3 18s. 9d.
- (5) £440

PAGE 9.

- (1) £55 1s. 9d.
- (2) £98 3s. 6d.
- (3) £20 18s. 8½d.
- (4) 34½ days
- (5) £7 9s. 9½d. + ½.

PAGES 14 and 15.

- (1) 4s. 0¾d.
- (2) £12 19s. 6½d. + 46
- (3) 26 coats
- (4) £90 17s. 8d.
- (5) 5 hrs. 7m. 53 sec. +

PAGE 17.

- (1) 4 days 9 hrs. 45 m.
- (2) £3 2s. 6d. +
- (3) £4 6s. 1½d. +
- (4) 957 bushels = 119 qrs. 5 bus.
- (5) 95 days 7 hours +

PAGES 20 and 21.

- (1) £158 3s. 3d.
- (2) £808 17s. 9¼d. +
- (3) 6s. 3¾d. +
- (4) 320 days 20 hrs. +
- (5) £138 1s. 7½d. +

PAGES 25 and 26.

- (1) £10 2s. 11¾d. +
- (2) £1043 16s. 2¾d. +
- (3) £23 11s. 9¾d. +
- (4) 21 yards
- (5) 73 dys. 10hs. 9m. +

PAGE 31.

- (1) 20½ men
- (2) 10 hrs. 40 min.
- (3) 37 days 12 hours
- (4) 133 a. 1 rd. 13½ pol.
- (5) 69 days 10 hours +

PAGE 34.

- (1) 21½ horses
- (2) 803 ac. 3 rd. 15 p. +
- (3) 30 days 4½ hours
- (4) £118 17s. 9¼d. +
- (5) 222 men +

PAGE 39.

- (1) 32 days
- (2) 16 men
- (3) 72 acres
- (4) 27 days
- (5) 12 hours

PAGE 43.

- (1) £222 7s. 7½d. +
- (2) 177 men +
- (3) 882 acres
- (4) 19 horses +
- (5) 60 days 9 hours

PAGE 47.

- (1) 3740 cu.ft. 448 in. +
- (2) 156 men +
- (3) 12 ac. 3 rds. 39 p.
- (4) 2190 lbs.
- (5) 34 dys. 4 hrs. 36 m. +

PAGES 50 and 51.

- (1) 7 days 4 hours +
- (2) 3 tns. 18 cwt. 24 lbs. +
- (3) 10 men +
- (4) 54 cannon +
- (5) 26 days 18 hrs. +

PAGES 56 and 57.

- (1) 35 ac. 1 rd. 4½ pls.
- (2) 27 dys. 3 hrs. 50 m. + 10'
- (3) 983½ lbs.
- (4) 154 men +
- (5) 10400 cubic feet

PAGE 63.

G. C. M.

- | | |
|---------|----------|
| (1) 70 | (6) 192 |
| (2) 56 | (7) 1728 |
| (3) 195 | (8) 4 |
| (4) 303 | (9) 243 |
| (5) 24 | |

L. C. M.

- | | |
|-----------|-----------|
| (1) 600 | (4) 960 |
| (2) 918 | (5) 23004 |
| (3) 57960 | (6) 2016 |

LOWEST TERMS.

- | | |
|--------------------|-------------------------|
| (1) $\frac{9}{20}$ | (5) $\frac{2}{3}$ |
| (2) $\frac{4}{15}$ | (6) $\frac{7}{15}$ |
| (3) $\frac{2}{3}$ | (7) $\frac{1025}{1441}$ |
| (4) $\frac{2}{11}$ | |

LEAST COMMON DENOMINATORS.

$\frac{45}{80}, \frac{54}{80}, \frac{25}{80}$
 $\frac{28}{40}, \frac{27}{40}, \frac{22}{40}$
 $\frac{42}{60}, \frac{55}{60}, \frac{56}{60}, \frac{23}{60}$
 $\frac{380}{720}, \frac{450}{720}, \frac{255}{720}, \frac{84}{720}$

PAGE 66.

LEGAR FRACTIONS, USED TO IMPROPER FRACTIONS.

$\frac{37}{4}$ (10) $\frac{3439}{48}$
 $\frac{51}{8}$ (11) $\frac{2408}{19}$
 $\frac{72}{10}$ (12) $\frac{4215}{88}$
 $\frac{25}{3}$ (13) $\frac{216439}{485}$
 $\frac{27}{5}$ (14) $\frac{729775}{754}$
 $\frac{192}{9}$ (15) $\frac{424753}{389}$
 $\frac{597}{16}$ (16) $\frac{1168040}{497}$
 $\frac{2182}{23}$ (17) $\frac{8183501}{1018}$
 $\frac{1720}{27}$ (18) $\frac{72243474}{4029}$

USED TO WHOLE OR MIXED NUMBERS.

$2\frac{2}{3}, 1\frac{1}{2}, 1\frac{1}{8}$

2, 9, 3

$6\frac{1}{5}, 4\frac{1}{11}, 6\frac{2}{5}$

$4\frac{15}{18}, 2\frac{15}{18}, 5\frac{5}{18}$

$7\frac{3}{8}, 5\frac{11}{8}, 7\frac{15}{8}$

$5\frac{4}{10}, 3\frac{5}{10}, 3\frac{27}{10}$

$1\frac{30}{173}, 4\frac{119}{173}, 48\frac{4}{173}$

$1\frac{904}{1001}, 8\frac{32}{46}, 10\frac{283}{46}$

PAGE 72.

$5\frac{3}{5}, 1\frac{1}{5}, 4\frac{11}{15}, 5\frac{1}{2}$

$16\frac{2}{15}, 6\frac{2}{15}$

$5\frac{11}{15}, 7\frac{7}{15}, 4\frac{11}{15}, 9\frac{9}{15}$

$4\frac{4}{21}, 36\frac{21}{21}, 47\frac{7}{21}$

$12\frac{24}{24}$

$1\frac{1}{54}, 1\frac{11}{108}, 1\frac{6}{81}, 1\frac{3}{54}$

$32\frac{1}{32}, 38\frac{1}{32}$

$1\frac{12}{125}, 7\frac{12}{125}, 54\frac{1}{300}, 1\frac{13}{300}$

$1\frac{1}{127}, 1\frac{5}{127}$

REDUCED TO SIMPLEST FORMS.

(1) $\frac{1}{2}, \frac{14}{33}$
 (2) $\frac{35}{88}, \frac{3}{8}$
 (3) $\frac{1}{2}, \frac{4}{51}$
 (4) $20\frac{22}{25}, 11\frac{3}{25}$
 (5) $546\frac{74}{888}$
 (6) $734\frac{31}{76}$

PAGE 77.

(1) $1\frac{1}{4}$
 (2) $2\frac{1}{4}$
 (3) $2\frac{83}{180}$
 (4) $6\frac{819}{744}$
 (5) $25\frac{13}{13}$
 (6) $25\frac{9}{10}$
 (7) $39\frac{44}{117}$
 (8) $12\frac{1}{3}$
 (9) $40\frac{183}{80}$
 (10) $51\frac{135}{135}$
 (11) $84\frac{167}{1804}$
 (12) $5\frac{5}{20}$
 (13) $13\frac{10}{10}$
 (14) $19\frac{18}{99}$
 (15) $18\frac{17}{17}$
 (16) $32\frac{77}{180}$

PAGE 79.

(1) $\frac{23}{23}, \frac{5}{19}$
 (2) $\frac{1}{8}, \frac{9}{20}$
 (3) $\frac{1}{10}, \frac{1}{10}$
 (4) $\frac{1}{10}, \frac{1}{10}$
 (5) $1\frac{17}{44}, 3\frac{1}{8}$
 (6) $2\frac{11}{10}, 1\frac{73}{208}$
 (7) $1\frac{12}{12}, \frac{1}{12}$
 (8) $2\frac{1}{10}, \frac{1}{10}$
 (9) $5\frac{1}{8}, \frac{1}{8}$
 (10) $24\frac{3}{40}$
 (11) $28\frac{2}{28}$
 (12) $28\frac{2}{28}$
 (13) $57\frac{73}{165}$
 (14) $80\frac{1}{8}$
 (15) $152\frac{1}{16}$
 (16) $798\frac{47}{321}$
 (17) $27\frac{1}{16}$
 (18) $842\frac{47}{185}$
 (19) $1\frac{1}{108}$
 (20) $64\frac{102}{133}$

PAGE 83.

(1) $2\frac{1}{35}, 1\frac{12}{35}$
 (2) $37\frac{8}{8}, 17\frac{31}{55}$
 (3) $82\frac{23}{88}$
 (4) $18\frac{31}{105}$
 (5) $95\frac{1}{77}$
 (6) $132\frac{169}{1386}$
 (7) $379\frac{1}{2}$
 (8) $7\frac{119}{736}$
 (9) $33\frac{1}{2}$
 (10) $17\frac{107}{144}$
 (11) $1\frac{19}{245}$
 (12) $21\frac{13}{15}$
 (13) $62\frac{597}{840}$
 (14) $18\frac{91}{18}$
 (15) $29\frac{389}{1454}$
 (16) $194\frac{11}{58}$

PAGE 88.

(1) $1\frac{1}{2}, 1\frac{12}{35}$
 (2) $2\frac{1}{11}, \frac{4}{9}$
 (3) $2\frac{1}{2}$
 (4) $\frac{87}{88}$
 (5) $\frac{35}{85}, \frac{35}{36}$
 (6) $1\frac{4}{19}, 1\frac{39}{200}$
 (7) $2\frac{4}{51}$
 (8) $1\frac{12}{51}$
 (9) $2\frac{59}{381}, 1\frac{139}{185}$
 (10) $537\frac{22}{25}$
 (11) $13\frac{25}{25}$
 (12) $5570\frac{64}{7811}$
 (13) $2\frac{2}{35}$
 (14) $152\frac{227}{320}$
 (15) $\frac{243}{880}$
 (16) $\frac{33815}{36688}$

REDUCED TO THEIR SIMPLEST FORMS.

(17) $1\frac{1}{2}; 1\frac{12}{35}; 5\frac{12}{35}; \frac{6}{25}$
 (18) $\frac{1831}{1434}; \frac{123}{2071}; \frac{123}{2071}$
 (19) $4\frac{1}{2}$
 (20) $\frac{723}{1540}$

408 ANSWERS TO THE EXAMPLES IN ARITHMETIC.

PAGE 91.

- (1) 16s.
- (2) 18s.
- (3) 19s. 3d.
- (4) 9d.
- (5) $\frac{3}{4}d. + \frac{1}{2}d.$
- (6) 18s. $6\frac{3}{4}d. +$
- (7) 2s. 4d.
- (8) 4s. 9d.
- (9) 1s. $5\frac{1}{4}d. +$
- (10) 9 lbs. 5 oz. $5\frac{1}{2}dms.$
- (11) 104 lbs.
- (12) 17 cwt. 2 qrs.
- (13) 3rd. 13pl. $10\frac{1}{12}yd.$
fur. p. yda. ft. in.
- (14) 8 6 4 2 $1\frac{5}{8}$
- (15) 2 qrs. 3nls. $0\frac{27}{28}in.$
- (16) 8 oz. 5 dwts. 8 grs.
- (17) 6 1 7 12 $7\frac{1}{8}$
- (18) £28
- (19) ton. cwt. qrs. lbs. oz.
1 9 2 3 8
- (20) m. fur. p. yda. ft.
27 1 31 0 1 +
- (21) yards qr. nls.
29 1 $2\frac{1}{2}$
- (22) lbs. oz. dwts.
444 1 10

PAGE 94.

- (1) $\frac{9}{35}$
- (2) $\frac{297}{3024}$
- (3) $\frac{125}{325}$
- (4) $\frac{223}{423}$
- (5) $\frac{131}{1440}$
- (6) $\frac{25}{53}$
- (7) $\frac{55}{50}$
- (8) $\frac{13}{50}$
- (9) $\frac{22}{375}$
- (10) $\frac{639}{2521}$
- (11) $\frac{7}{51}$
- (12) $\frac{77}{486}$
- (13) $\frac{2098}{181}$
- (14) $\frac{6}{181}$

PAGE 99.

- (1) $66\frac{771}{1408}$
- (2) $51\frac{3419}{14960}$
- (3) $\frac{122}{345}$
- (4) $2\frac{3}{4}$
- (5) $\frac{102267}{20657446}$
- (6) The latter by $\frac{1}{32}$
- (7) $3\frac{233}{275}$
- (8) $10\frac{404210}{1364219}$

PAGE 105.

- (1) £28 2s. $3\frac{3}{4}d. + \frac{2}{3}$
- (2) $117\frac{182551}{298080}$ lbs.
- (3) $10\frac{421}{1476}$
- (4) $\frac{56}{10400}$
- (5) £25,375
- (6) £186 12s. $6\frac{1}{2}d. +$

PAGE 109.

EXPRESS IN DECIMALS.

- (1) .2 .5 .25
- (2) .04 .1 .475
- (3) 3.833 5.8 15.795

EXPRESS IN FRACTIONS.

- (4) $\frac{1}{10}, \frac{1}{2}, \frac{1}{5}$
- (5) $\frac{1}{4}, \frac{2}{5}, \frac{3}{25}$
- (6) $\frac{7}{8}, \frac{489}{500}, \frac{4157}{200}$
- (7) $\frac{14}{25}, \frac{57}{125}, 731\frac{1}{2}$
- (8) $\frac{41827}{2000}, 968\frac{1183}{25000}$
- (9) $83\frac{4232}{50000}, 26\frac{524}{8125}$

PAGE 113.

- (1) 1043 999783
- (2) 9701.570361
- (3) 2434.167
- (4) 1209.2443
- (5) 1146.8633
- (6) 1057.4604
- (7) 48.892; 16.09
- (8) 79.4681
- (9) 68.395; 33.645
- (10) 412.2661

PAGE 117.

- (1) 17.86; .6794;
1414.686301;
.178362; .0272
- (2) .32919532;
.0672752796;
551.631236; .0001
- (3) .29 .000475;
13871.428571;
.00078125; 35.84
- (4) 137500; 562.8;
.0032; .05483

PAGE 122.

- (1) .166; .0714285; .1;
.045; .428571;
.0238095; .1923076;
.052631578947368421;
.7954;

.0020242914979757085

- (2) $\frac{1}{8}, \frac{7}{8}, \frac{5}{80}, 6\frac{333}{37}, \frac{5}{37}, \frac{282}{483}, \frac{19}{483}, \frac{1106}{24975}$
- (3) 110.182109
- (4) 83.290745
- (5) 11.633933
- (6) 140.227576
- (7) .0271222,
63.0823173,
56.5417417

PAGE 127.

- (1) 19.8126
376.873553
20.98755118
3.944832
- (2) .5301818
81.742227
2.342222
133.705303
- (3) 1854.3657
17.4
235.6521
40.6125
- (4) .955565
2.810
2.672
57.32571428

PAGE 131.

- (1) 15s.; 12s. 6d.; 14s. 6d.; 9s. 8½ 6d.;
2s. 10 104d.; 15s. 8½ 848d.;
8s. 3½ 36d.
- (2) 3d.; 3½ 6d.; 1½ 832d.;
4½ 9824d.; 9½ 0288d.;
10 0368d.; 2½ 328d.
- (3) 58 farthing; ¼ 46d.; ¼ 94d.;
13s. 6d.; 16s. 10½ 2d.; 18s. 6d.;
5½ 6d.
- (4) 15 cwt. 6oz. 15 dwt. 8·64 grs.;
7 dwts. 8·64 grs.; 2 qrs. 22 lbs.
4 oz. 9·728 drms.; 15 lbs.
14 oz. 7·424 drms.; 7 furl.
5 per. 2 yds. 1 ft. 3·12 in.;
2·0193 ft.
- (5) 20 hrs. 51 min. 21·6 sec.;
£1 0s. 6·1572d.; 11 min.
10·248 sec.; 16s. 6½ 468d.

PAGE 137.

- (1) ·25; ·2; ·125
- (2) ·3; ·16; ·6
- (3) ·475; ·2625; ·116
- (4) ·2768 +; ·16957 +; ·18703
- (5) ·12658; ·120155
- (6) ·1866; ·39934
- (7) ·067164; ·106876
- (8) ·4591049382716; ·6
- (9) ·65; ·00082644
- (10) ·180208; ·0014451
- (11) ·275; ·15
- (12) ·176976; ·2045

PAGE 142.

- (1) £10 10s. 2·16 2d.
- (2) £12 1s. 3½ 9925d.
4s. 8½ d. +
- (3) ·109756
·108433 +
17;
10;
13;
·69618055
- (4) £186 0s. 2½ d. +
- (5) 12s. 11d.
- (6) £43 1s. 7½ 4d.
- (7) 19 878229
2885375

PAGE 145.

- (1) 34587; 48946; 82884;
93704; 47056 mls.
- (2) £86 9 fl. 7 c. 8 m.;
56 8 4 3;
96 8 8 9;
58 6 7 9;
896 7 9 1
- (3) 27890; 56500; 476850;
569162½; 84250; 96752½ mls.
- (4) £1479 8 fl. 9 c. 8 m.;
26 8 2 9;
9 6 0 2

PAGE 148.

- (1) £5 4 fl. 6 c. 6½ m.;
7 7 9 1·6;
74 2 2 7·089;
3 1 6 2·5
4 0 8 1·25
- (2) £38 13s. 9·12d.;
50 14 9½ 4;
45 19 8½ 56;
782 16 2·16
- (3) £34 6 fl. 8 c. 1·25 m.
4 7 3 5·416;
819 1 0 0;
549 6 2 5;
£6 18s. 4½ + 2d.;
17 14 0½ 88
- (4) £3559 6 fl. 6 c. 2·5 m.;
6 8 3 2·908
1257 5 2 5
- (5) 198 1 1 4·583

PAGE 151.

- (1) 11½ 02233; 25½
158400
- (2) £11 12s. 0½ + ½
- (3) 10795725 or nearly ½
24622358
- (4) 1s. 7½ 01515008d.
- (5) £435 2s. 0½ 3792d.
- (6) 433 ac. 3 rds. 20 poles

410 ANSWERS TO THE EXAMPLES IN ARITHMETIC.

PAGE 155.

- (1) £346 4s. 7½d.
- (2) £3 11 4
- (3) £6 11 10½
- (4) £275 19 10½
- (5) £29 5 7½
- (6)

PAGE 159.

- (1) £41 14s. 3½d.
- (2) 4 tons 11 cwt. 2 qrs. 14½ lbs.
- (3) 8 tons 8 cwt. 1 qr. 10 lbs.
- (4) £64 2s. 2½d.
- (5) £63 15 0

PAGE 165.

- (1) £6 5s. 0d.
- (2) £42 3 9
- (3) £17 13 6
- (4) £21 6 8½
- (5) £9 12 2½
- (6) £100 19 3½

PAGE 171.

- (1) £8 6s. 8d.
- (2) £2500 0 0
- (3) £3 2 6
- (4) £2 5 6
- (5) £65 10 0
- (6) £333,333,333 6 8

PAGE 174.

- (1) £3693 15s. 0d.
- (2) £6578 18 11½
- (3) 86½ shares
- (4) £4250 0 0
- (5) £288 5 5½
- (6) £11 3 11½

PAGE 178.

- (1) 56½ per cent.
- (2) 2000 yards
- (3) £12,000
- (4) 2s. 6d.
- (5) £760
- (6) 432 in reading,
369 in writing,
342 in arithmetic.

PAGE 185.

- (1) £37 10s. 0d.
- (2) £5363 1 10½
- (3) 25 years
- (4) 3½ per cent.
- (5) £5122 4 0½
- (6) £85 18 6

PAGE 190.

- (1) £180 16s. 6½d.
- (2) £1004 6 0
- (3) £112 10 0
- (4) £7000 0 0
- (5) £8750 0 0
- (6) 18 years 24 weeks
- (7) £4000 0 0

PAGE 194.

- (1) £5 0s. 4½d.
- (2) £12 12 0
- (3) £2 15 6½
- (4) £10 4 11
- (5) £7 3 0½
- (6) £158 9 10½
- (7) £5351 16 8½

PAGE 198.

- (1) £2 13s. 8½d.
- (2) £31 0 0½
- (3) £992 2 8½
- (4) £4378 14 6
- (5) £532 1 4½
- (6) £800 0 0
- (7) 76 days

PAGE 203.

- (1) £30 12s. 11½d.
- (2) £85 19 1½
- (3) £670 0 11½
- (4) £34 0 2½
- (5) £65 15 11

PAGE 209.

- (1) £215 10s. 1½d.
- (2) £208 8 6½
- (3) £258 9 9½
- (4) £764 0 0
- (5) £21 0 0

PAGE 214.

- (1) £2 0s. 0d.
- (2) £224 18 10 $\frac{1}{2}$
- (3) £6 13 8 $\frac{1}{2}$
- (4) 5 per cent.
- (5) 2 months

PAGE 220.

- (1) £6 5s. 5 $\frac{1}{2}$ d.
- (2) £365 9 11 $\frac{1}{2}$
- (3) £19 6 9 $\frac{1}{2}$
- (4) £77 14 6 $\frac{1}{2}$
- (5) £750 0 0
- (6) 3s. 10d. gain

PAGE 226.

- (1) (£373 6s. 8d.
- (2) A. 24 $\frac{1}{2}$; B. 54 $\frac{1}{4}$; C. 61 $\frac{1}{2}$
- (3) { A. £687 10 0; B. £687 10 0
C. £1937 10 0; D. £4437 10 0
- (4) { A. £1312 10 0; B. £1312 10 0
C. £3187 10 0; D. £6937 10 0

PAGE 238.

- (1) { A. £2023 14s. 4 $\frac{1}{2}$ d.
B. £1039 19 4
C. £396 6 2 $\frac{3}{4}$
D. £656 13s. 4 $\frac{1}{2}$ d.
- (2) { X. £882 13 4 $\frac{1}{2}$
Y. £1407 13 4 $\frac{1}{2}$
Z. £213 6 8
- (3) £213 6 8

PAGE 237.

- (1) 147456
- (2) 762129
- (3) 3189796
- (4) 16807
- (5) 961504803.
- (6) .04
- (7) .001
- (8) $\frac{1}{4}$
- (9) .2451

PAGE 246.

- (1) 9
- (2) 79
- (3) 976
- (4) 1-25992
- (5) .584803
- (6) 3 $\frac{1}{8}$
- (7) 1

PAGE 253.

- (1) 87 sq. ft. 2' 3"
- (2) 3 sq. ft. 9' 11" 3"
- (3) 37 sq. ft. 6' 2"
- (4) 223 c. ft. 10' 7" 7"
- (5) 87 sq. ft. 27 in.
43 sq. ft. 119 $\frac{1}{4}$ in.
37 sq. ft. 6 $\frac{1}{8}$ in.
223 c. ft. 1531 in.

PAGE 258.

- (1) 729 sq. ft.
- (2) 38 sq. ft. 83 in.
- (3) 7 ft. 9 in.
- (4) 730 sq. ft. 92 in.
- (5) 543 sq. ft. 117 in.
- (6) 28-275 sq. chains
- (7) 143 yards 95-7 yds.
13685-1 sq. yds.

PAGE 264.

- (1) 13 sq. ft. 81 in.
- (2) 6 ac. 6-25 chains
- (3) 4-8 chains
- (4) 25090-56 sq. yards
- (5) £13 1s. 2d.

PAGE 268.

- (1) 1048 yds.
- (2) 48 $\frac{1}{2}$ ft.
- (3) 170 yds.
- (4) 20 chains
- (5) 4 ac. 2 r. 24 p. 9 yds.

PAGE 272.

- (1) 53 ft.
- (2) 109 ft.
- (3) 124-48 ft.
- (4) 17-204 ft.
- (5) 41-6173 ft.

PAGE 276.

- (1) 56 ft. 2-9364 in.
- (2) 271 yds. 2 ft. 2-0712 in.
- (3) 171 yds. 5-652 in.

412 ANSWERS TO THE EXAMPLES IN ARITHMETIC.

PAGE 282.

- (1) 84 sq. yds.
- (2) 29 ac. 7 p. 1752 yds.
- (3) 561·1844 sq. ft.
- (4) 66 sq. yds. 6 ft.
- (5) £12 18s. 8½d.

PAGE 287.

- (1) 209·572 sq. yds.
- (2) £19 17s. 8¼d.
- (3) 27 ac. 10 p. 3·388 yds.
- (4) 19·74 ft.
- (5) 40·2073 ft.

PAGE 291.

- (1) 3300 sq. yds.
- (2) 4 ac. 20 p.
- (3) 25 ac. 1r. 31 p. 16·166 yds.
- (4) 39 sq. ft.
- (5) 9 ac. 2 r. 21·1 poles

PAGE 295.

- (1) 47·124 ft.
- (2) 62·832 ft.
- (3) 25000·8528 miles.
- (4) 31·8315 ft.
- (5) 75 lbs. 6 oz. 5·99 drs.
- (6) 241·9149 ft.

PAGE 299.

- (1) 1256·64
- (2) 6·73565
- (3) 15708
- (4) 314·16 sq. ft.
- (5) 55·5088 yds.
- (6) 25 ac. 2 r. 38 p. 23 yds.

PAGE 303.

- (1) 125 c. ft.
- (2) 421 c. ft. 512 in.
- (3) 2744
- (4) 12 cwt. 2 qrs. 3 lbs. 12 oz.
15 drs.
- (5) 2 tons 8 cwt. 8 lbs. 11·67 oz.

PAGE 307.

- (1) 15 c. ft. 1080 in.
- (2) 173 c. ft. 1056 in.
- (3) 3 ft. 2½ in.
- (4) 29 c. ft. 1188 in.
- (5) 13 tons 6 cwt. 2 qrs. 11 lbs.
6 oz.

PAGE 310.

- (1) 320 sq. ft.
- (2) 11 yds. 2·412 in.
- (3) 1963·5 c. ft.
- (4) 5 ft. 7·9 in.
- (5) 8 tons 17 cwt. 2 qrs. 15 lbs.

PAGE 315.

- (1) 141·372 sq. ft.
- (2) 816 sq. ft.
- (3) 8·83575 c. ft.
- (4) 19 lbs. 6·76 oz.
- (5) 18·0416 c. ft.

PAGE 319.

- (1) 1256·64 sq. in.
- (2) 198944286·35235 sq. miles
- (3) 6·77 in.
- (4) 1 c. ft. 844·4468 in.
- (5) 42 lbs. 2·135 oz.
- (6) £22 3s. 1¾d.

PAGE 325.

- (1) 3·7147 rods
- (2) 5·5095 rods
- (3) £128 0s. 3¼d.
- (4) 26·1066 rods: £80 18s. 7½d.

PAGE 330.

- (1) 1377 sqs. 92 ft. 3 in.
- (2) £32 1s. 1½d.
- (3) £39 15s. 7d.
- (4) 912½ lbs.
- (5) £111 18s. 3d.

PAGE 336.

- (1) £1 6s. 9½d.
- (2) £8 15 0¾
- (3) £1 4 10¼

PAGE 342.

- (1) 30¾ squares
- (2) £23 14s. 3½d. + ⅔
- (3) £22 8 0

PAGE 348.

- (1) £96 5s. 0d.
- (2) 1728
- (3) £3988 18s. 1½d.
- (4) 1500 c. ft.
- (5) 899 c. ft. 16 in.

PAGE 354.

- (1) £11 12s. 10½d.
- (2) £31 8 4
- (3) £11 6 2¼ + 11⅓
- (4) £7 18 11½

PAGE 359.

- (1) 50 yds. 1 ft. 6½ in.: £9 7s. 6d.
- (2) £1 6s. 3¼d.
- (3) £2 5 0
- (4) £3 3 10¾

PAGE 362.

- (1) 79 loads
- (2) 34 days 6¾ hours
- (3) 4s. 2d.
- (4) 36
- (5) £6 15s. 1·024d.

PAGE 367.

- (1) 62s. 8¼d.
- (2) £35 12s. 5d. gain
- (3) 70·7353 ft.
- (4) 253½
- (5) 22½ days

PAGE 374.

- (1) £1 per yard
- (2) 5 dwts. 3½ grs.
- (3) £127 10s. 0d.
£354 12 0
£217 18 0
- (4) 277·273 c. in.
- (5) 7·57 inches, nearly

PAGE 379.

- (1) 7s. 10·248d.
- (2) £858 10s. 5¼d.
- (3) £313 7 9¾
- (4) 122½
- (5) £6¼ per cent. gain

PAGE 384.

- (1) £2360 9s. 9½d.
- (2) £4098 7 2½
- (3) 4d. on 5s. 8d. causes the greater loss by 6s. 6½d. per cent.
- (4) £219 2s. 3d.

PAGE 389.

- (1) 3899 ac. 1 r. 27 p.
- (2) £13705 17s. 6d.
- (3) 250 ft. per min.
- (4) 3600 stones: £281 5s.
- (5) £2 5s. 11½d.
- (6) 2 hrs. 11 min. 20 sec.

TABLES OF WEIGHTS AND MEASURES.



AVOIRDUPOIS WEIGHT FOR ALL COMMON GOODS.

16 drams	= 1 ounce (oz.)
16 ounces	= 1 pound (lb.)
28 pounds	= 1 quarter (qr.)
4 quarters	= 1 hundredweight (cwt.) (112 lbs.)
20 hundredweight	= 1 ton.

 APOTHECARIES' WEIGHT,

For Mixing and Preparing Medical Prescriptions.

20 grains	= 1 scruple (sc.)
3 scruples	= 1 dram.
8 drams	= 1 ounce.
12 ounces	= 1 lb.

The grain, ounce, and pound, are the same as in troy weight.

 TROY WEIGHT,

For Precious Stones and Metals, and in Philosophical Experiments.

24 grains	= 1 pennyweight (dwt.)
20 pennyweights	= 1 ounce (oz.)
12 ounces	= 1 pound (lb.)
A pound troy contains 5760 grains.	
A pound avoirdupois contains 7000 grains.	

LONG MEASURE.

12 lines	= 1 inch.
12 inches	= 1 foot.
3 feet	= 1 yard.
5½ yards	= 1 pole, rod, or perch.
40 poles	= 1 furlong.
8 furlongs	= 1 mile
	(1760 yards, or 5280 feet).
3 miles	= 1 league.

Land is usually measured by a chain of 100 links, and 22 yards in length. A square chain is, therefore, 10,000 square links, or 484 square yards, i.e. $\frac{1}{16}$ th of an acre. And an acre is 100,000 square links.

CLOTH MEASURE.

2½ inches	= 1 nail.
4 nails	= 1 quarter.
4 quarters	= 1 yard.
5 quarters	= 1 ell.

CUBIC OR SOLID MEASURE.

1728 cubic inches	= 1 cubic foot.
27 cubic feet	= 1 cubic yard.

DRY MEASURE.

4 gills	= 1 pint.	4 bushels	= 1 coomb.
2 pints	= 1 quart.	2 coombs	= 1 quarter.
4 quarts	= 1 gallon.	5 quarters	= 1 load.
2 gallons	= 1 peck.	3 bushels	= 1 sack.
4 pecks	= 1 bushel.	12 sacks	= 1 chaldron.

SQUARE OR SUPERFICIAL MEASURE.

144 square inches	= 1 square foot.
9 square feet	= 1 square yard.
30½ square yards	
(272½ square feet)	= 1 square rod, pole, or perch.
40 square rods	= 1 rood
4 roods	= 1 acre
(10 square chains, 100,000 square links, 4840 square yards).	
640 acres	= 1 square mile.

BEER MEASURE.

36 gallons = 1 barrel.
3 barrels = 1 butt.
54 gallons = 1 hogshead.

WINE MEASURE.

63 gallons = 1 hogshead
2 hogsheads = 1 pipe.
2 pipes = 1 tun.

The measure for quantities smaller than a gallon are the same as in dry measure.

A cubic foot of water weighs 62·5 lbs. av. i.e. 1000 ounces.

A gallon is 277·274 cubic inches.

A gallon of water weighs 10 lbs.

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